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GRANULOMATOUS ULCER OF THE NOSE AND FACE

OF UNKNOWN CAUSE, USUALLY PROGRESSIVE, GANGRENOUS AND FATAL

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This presentation will consist of a short review of the literature on the subject described by the title and a report of 4 cases in which treatment was given by personal acquaintances or by me. A fifth case is mentioned, which closely resembles those which terminated fatally. It is hoped that this study will stimulate interest in the subject and possibly lead to further research in this country concerning the cause of the disease.

REVIEW OF THE LITERATURE

Fatal granulomatous ulcerations of the nose and face have been described under various titles. In 1896 McBride [1] described a "case of rapid destruction of the nose and face." The following year Jones [2] described a case of "esthiomenic menstrual ulcer of the nose." In 1906 Fordyce [3] presented "a case of undetermined tropical ulcer involving the nose, pharynx and larynx, with histological findings." In 1914 Nabarro [4] discussed "an obscure case of ulceration of the nose in a child, simulating an epithelioma." In 1921 Woods [5] described 2 cases of "malignant granuloma of the nose." In 1925 M'Arthur and Dew [6]

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1. McBride, P.: Case of Rapid Destruction of the Nose and Face, J. Laryng. & Otol. **12**:64, 1897.

2. Jones, H. M.: Esthiomenic Menstrual Ulcer of the Nose, J. Laryng. & Otol. **12**:301, 1897.

3. Fordyce, J. A.: A Case of Undetermined Tropical Ulcer Involving the Nose, Pharynx and Larynx, with Histological Findings, J. Cutan. Dis. **44**:1, 1906.

4. Nabarro, D.: An Obscure Case of Ulceration of the Nose in a Child Simulating an Epithelioma, Brit. J. Surg. **1**:576, 1914.

5. Woods, R.: Malignant Granuloma of the Nose, Brit. M. J. **2**:65 (July 16) 1921.

6. M'Arthur, G. A. D., and Dew, H. R.: Case of Malignant Granuloma of the Nose, J. Laryng. & Otol. **40**:378-380 (June) 1925.

described another such case. In 1929 Chatellier [7] reported a case of "sarco-lupus pernio, mutilant et mortal." In 1931 I had the pleasure of listening to Dr. G. B. Wood, of Philadelphia, present his case of "mutilating granuloma of the nose and face, with fatal ending" before the American Laryngological Association.[8] This was the first American case reported. His report was so complete that I have little to add.

In 1933 Stewart [9] reported on "progressive lethal granulomatous ulceration of the nose." He added 4 unreported cases and carefully reviewed the literature, including 8 cases which had been reported previously. He said that he considered the cases of Jones, Fordyce and Nabarro to be slightly atypical. Stewart also discussed differential diagnosis and allied conditions. His paper must be read by any one interested in this subject.

In 1936 Joisten [10] reported 2 cases, "zwei ätiologisch unklare Fälle von gangränescierender Entzündung der Nase und des Oberkiefers." He reviewed the literature, citing Berendes,[11] who collected 16 cases from the German literature, 9 from the English literature and 1 each from the French, Japanese and Italian literature.

Bayer,[12] in 1937, and Schütz,[13] in 1938, reported cases under similar German titles. Alfred Lewy,[14] of Chicago, reported the second American case, that of a girl of 11 years, under the title "A Case of Gangrenous Osteomyelitis of the Paranasal Sinuses." In 1939 Wegener [15] reported 3 cases, with autopsy studies. He discussed the pathologic findings and etiologic possibilities.

REPORT OF CASES

CASE 1.—A man aged 51 years, a private patient of Dr. C. D. Knowlton, came to him on Aug. 8, 1936 complaining of a swelling of the right side of the nose and face and of fever. The illness began in November 1935. At that time he noted

7. Chatellier, L.: Sacro-lupus pernio mutilant et mortel, Ann. de dermat. et syph. **10**:1213-1230 (Nov.) 1929.

8. Wood, G. B.: A Case of Mutilating Granuloma of the Nose and Face with Fatal Ending, Tr. Am. Laryng. A. **53**:63-71, 1931.

9. Stewart, J. P.: Progressive Lethal Granulomatous Ulceration of the Nose, J. Laryng. & Otol. **48**:657-701 (Oct.) 1933.

10. Joisten, E.: Zwei ätiologisch unklare Fälle von gangränescierender Entzündung der Nase und des Oberkiefers, Ztschr. f. Hals-, Nasen- u. Ohrenh. **41**:105-128 (Sept. 16) 1936.

11. Berendes, J.: Granuloma gangränescens, München. med. Wchnschr. **81**: 2005, 1934.

12. Bayer, H. G. A.: Ätiologisch unklare, gangräneszierende Erkrankungen des Nasenskeletts, Hals-, Nasen- u. Ohrenarzt (pt. 1) **28**:83-94 (April) 1937.

13. Schütz, W.: Verschiedene Formen von Gangrän der Nase und Nasennebenhöhlen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **44**:244-250, 1938.

14. Lewy, A.: A Case of Gangrenous Osteomyelitis of the Paranasal Sinuses, Arch. Otolaryng. **27**:91-94 (Jan.) 1938.

15. Wegener, F.: Ueber eine eigenartige rhinogene Granulomatose mit besonderer Beteiligung des Arterien-systems und der Nieren, Beitr. z. path. Anat. u. z. allg. Path. **102**:36-68, 1939.

stuffiness of the nose and frontal headache on the right, with a sense of tightness over the area of the right antrum; the headache was present when he awakened in the morning and increased through the day. At the onset there was a little mucoid discharge from the nose. The obstruction, however, became marked, and treatment with sprays did not relieve the condition.

Electrocoagulation of the turbinates did not help, and it was necessary for the patient to sit up or to have his head propped up in order to sleep. His teeth were said to have been in poor condition, and through the winter and spring all of them were extracted. By April 24, 1936 he felt much better. The headache was relieved, and there was some improvement of the stuffiness in the nose. He was well until June 12, when severe headache and generalized pains in the muscles and joints developed. These manifestations were accompanied by chill and a rise in temperature to 105 F. At this time he entered the local hospital. Within eight days his temperature receded but after two days of normal temperature fever developed again, and his condition remained septic until his death. During his stay in the hospital a puffiness developed beneath the right eye but soon receded.

After the chill in June, the patient's appetite, which had been fair, was poor, and at times there was nausea, with occasional vomiting. About July 10 swelling and tenderness were again noted along the right side of the nose; there was no nasal bleeding and only a moderate amount of nasal discharge. On August 8 he entered the Massachusetts General Hospital for study and treatment. Smears and cultures of discharges, blood cultures, studies for fungous infection and studies of the blood were made. On August 14 Dr. Knowlton and Dr. G. B. Fred explored the right antrum. It contained pus and polypoid membrane, which were removed. Biopsy specimens were taken from the inside of the right ala nasi, from the right ethmoid region and the septum and from the external surface of the nose. At this time there were swelling and tenderness of the nose and face, with an ulcerated area, and perforation through the right lateral wall of the nose, extending slightly on the cheek. The temperature ran a septic course from normal to 106 F., remaining for the most part between 103 and 104 F. The patient had only moderate pain, was strong enough to be up and felt surprisingly well considering the rise in temperature and his septic condition. Roentgenographic reports indicated that his chest was entirely normal.

Roentgenograms of his sinuses showed soft tissue in both ethmoid sinuses and fluid in the right antrum but no osteomyelitis. The Wassermann test of the blood, the Hinton test on two occasions, the Widal test and blood cultures on several occasions all were negative. The leukocyte count varied from 5,600 to 12,600. The differential count varied as follows: polymorphonuclear cells, 60 to 73 per cent, and lymphocytes, 27 to 33 per cent, with only a small number of monocytes and eosinophils. The hemoglobin content varied from 60 to 72 per cent. The spinal fluid showed normal cells and protein. The Wassermann and Hinton tests of the spinal fluid were negative. The biopsy report was: "granuloma consistent with late syphilis." On August 26 a second biopsy specimen was taken, and again nothing new was observed on study of the sections. The cultures showed a predominance of diphtheroids, staphylococci and streptococci, with both hemolytic and nonhemolytic streptococci present. Practically a pure culture of Staphylococcus was obtained from pus taken from the antrum. A smear and cultures were negative for fungus and for acid-fast organisms. Some gram-positive bacilli and gram-positive diplococci, possibly pneumococci, were found. The blood cultures all gave negative results, as did a search for malarial parasites.

Treatment consisted of a high vitamin and high caloric diet, cleansing of the wound by irrigation with a 1:10,000 solution of potassium permanganate, the appli-

cation of magnesium sulfate packs and the use of diluted solution of sodium hypochlorite U. S. P. and a solution of acriflavine. Infra-red rays were applied to the area daily. Quinine was given in large doses for four days, without effect. This was discontinued, and potassium iodide was given in doses up to 90 grains (5.8 Gm.) a day.

In spite of the best local and general care that could be given, the patient's condition rapidly became worse, with extension of the lesion and continuance of the high fever. Near the end of his stay in the hospital two transfusions were given, with no apparent benefit. His pulse rate varied from 80 to 160, his respirations from 20 to 40 and his temperature from normal to 106 F. He died from a massive hemorrhage on September 30, eleven months after coming under medical care.

CASE 2.—On Sept. 4, 1937, a man aged 35 years was admitted to the Massachusetts Eye and Ear Infirmary, with the chief complaint of swelling of the right side of the face. The illness had begun in the early part of February, with swelling of the right side of the face and a thin nasal discharge, which later became foul. He was treated by his physician, but the swelling of the face persisted, and the foul nasal discharge became more marked. The postnasal discharge had been of considerable concern to him, because he had lost his appetite and with this had

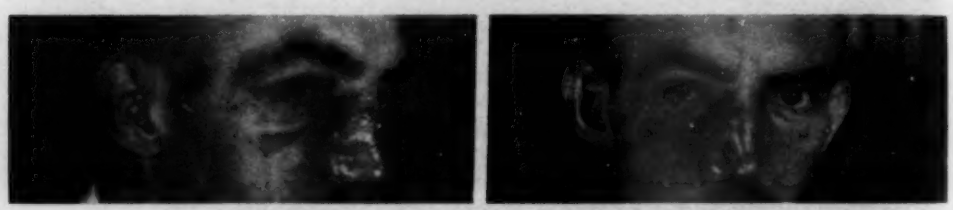


Fig. 1 (case 2).—Ulcer in the region of the right lacrimal sac, with fistula into the nasal cavity.

lost weight to the extent of 25 pounds (11 Kg.) before being admitted to the hospital. He had become too weak to carry on work and two weeks previous to admission had had some pain on swallowing, with a slight cough.

He had had influenza in 1917. He could not remember any illness since that time. He was married. His wife and two children were well.

A general physical examination revealed no abnormality other than emaciation. The heart and lungs were normal. The face showed a hard brawny reddened and tender area over the frontal process of the maxilla on the right side, with some ulceration and a draining fistula (fig. 1). Inspection of the interior of the nose showed the anterior half of the nasal septum to be destroyed and the nasal chambers covered with heavy foul crusts and pus. The mouth revealed tenderness of the gums on the right side. The teeth were in bad repair. Postnasally there was marked purulent discharge, and the tonsils were reddened. The anterior cervical glands were palpable.

Roentgenograms of the sinuses revealed pansinusitis on the right. Roentgenograms of the teeth showed apical abscesses of the right central incisor and left upper second molar. Laboratory examination of the blood resulted as follows: The Wassermann and Hinton tests were negative; the blood sugar and nonprotein nitrogen contents were normal; the leukocyte count was 9,100 and the erythrocyte

count, 3,350,000; the hemoglobin content varied between 64 and 80 per cent; the differential count revealed 74 per cent polymorphonuclears and 26 per cent lymphocytes.

Smears from the lesion did not show the tubercle bacillus or Vincent's organisms but showed gram-positive diplococci. Both aerobic and anaerobic cultures yielded Staphylococcus aureus. The blood cultures were sterile. Cultures for fungi were negative. A biopsy specimen showed acute and chronic inflammation. The bone revealed acute and chronic osteomyelitis. The urine was normal.

Treatment consisted of nasal irrigations, application of hot poultices and oil sprays, packing of the wound with urea and application of cupric sulfate. Both arsphenamine and antimony and potassium tartrate were given a trial, without effect. Extraction of the abscessed teeth and hygienic care of the mouth were carried out. The temperature varied between the normal and 104 F., the pulse rate between 70 and 125 and respirations between 20 and 28.

In spite of treatment and further care after discharge from the hospital, the patient died on Dec. 11.

Case 3.—On Jan. 1, 1938 a man aged 57, a stone cutter, was referred to the Lahey Clinic by Dr. M. C. Twitchell, because of nasal obstruction and swelling and ulceration of the nose. The history is interesting in that in 1915 a biopsy specimen was taken from a granuloma on the right side of the nose; the microscopic report was that the structure of the tissue was that of an infectious granuloma with small necrotic areas scattered throughout the mass. No tubercle bacilli were found. The patient was treated with old tuberculin. This granuloma healed completely, and he was well, without any disability or disease that he could recall, until the spring of 1937. In April 1937 the nose became stuffy, and there was a thin nasal discharge. He was treated by a competent rhinologist, without improvement. In August his nose was much more obstructed and his temperature rose to levels of from 100 to 102 F. To relieve obstruction, a portion of the turbinates was removed, without success. A biopsy specimen taken by his rhinologist showed chronic inflammation without evidence of malignant disease.

In spite of treatment, the lesion progressed, the discharge became bloody and crusting in the nose became severe. On September 14 a second biopsy was performed. The specimen showed chronic inflammation. The temperature rose from 103 to 104 F. The patient changed physicians on October 25, at which time there was marked crusting of the left nasal cavity near the anterior end of the left middle turbinate, where bare bone was demonstrated. Indurated tissue was present about the area of ulceration, and externally there were swelling and a marked dusky redness of the nose, with edema of the lower left eyelid.

Roentgen examination of the sinuses at this time showed them to be clear. Roentgenograms of the chest demonstrated moderately advanced silicosis, without evidence of accompanying tuberculosis. The biopsy specimen taken at this time consisted largely of necrotic and inflammatory tissue, and many blood vessels, some with thick walls, were scattered in this mass, but the endothelial cells were uniform in size and shape. No atypical epithelial cells were found, and there was no evidence of malignant disease. A diagnosis could be made only of inflammatory granuloma. Tubercle bacilli could not be demonstrated in the sputum. The Wassermann test was negative on several occasions. Two roentgen treatments were given, with temporary improvement, and they were followed by injections of tuberculin every fifth day.

A

B

C

Fig. 2 (case 3).—*A*, external ulceration, induration and swelling of the nose and left cheek, Jan. 24, 1936. *B*, lateral view taken on the same date as *A*. *C*, enlargement of opening through the lateral wall of the nose, Feb. 19.

During the first week in December the swelling and redness in the nose increased and some ulceration appeared on the surface. Roentgen treatments were again given without benefit and on December 20 were discontinued. In spite of the fact that the Wassermann test had been negative on several occasions, active antisyphilitic treatment was given with a bismuth compound, potassium iodide and intravenously administered arsphenamine. The lesion continued to advance, and the antisyphilitic treatment was discontinued on Jan. 12, 1938, by which time an opening had formed through the lateral wall of the nose.

The photographs (fig. 2) were taken on Jan. 24, 1938, when the patient was first seen by me. He was then admitted to the New England Deaconess Hospital,

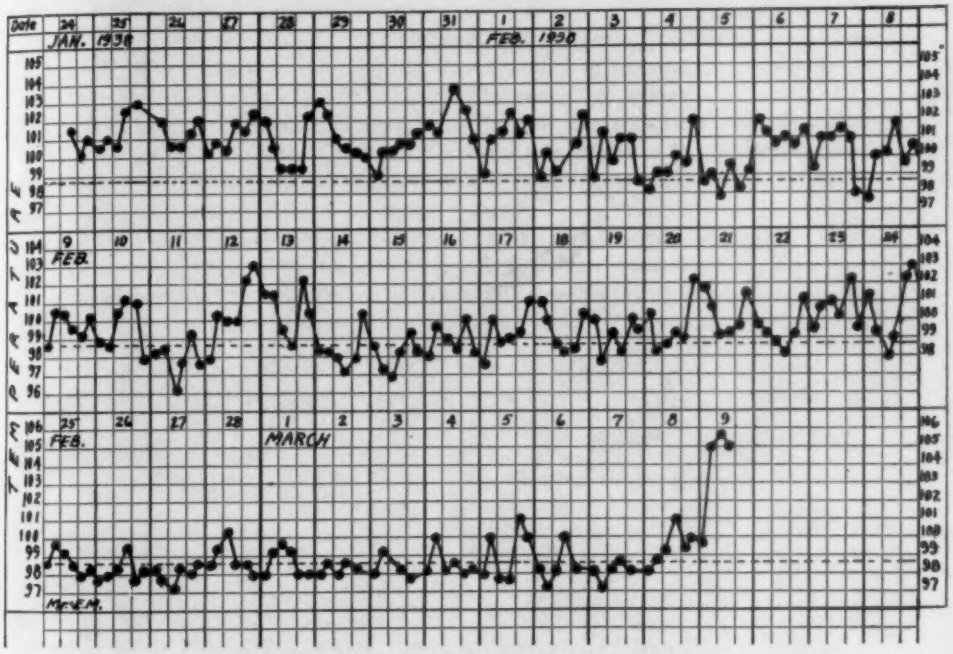


Fig. 3.—Temperature chart in case 3.

where an effort was made to establish a diagnosis. Roentgenograms of the sinuses and chest again showed nothing abnormal. Studies of the blood were repeated at intervals. The hemoglobin content of the blood varied from 66 to 80 per cent. The leukocyte count varied from 10,000 to 14,000. The differential count showed a variation in polymorphonuclear cells of 70 to 80 per cent and many young forms. The urine remained normal throughout. Another biopsy was done, with findings the same as those previously reported. Cultures showed hemolytic Staphylococcus aureus, hemolytic and nonhemolytic streptococci, and diphtheroids, which were found to be nonvirulent. Numerous slides and smears were made in an effort to find the tubercule bacillus, Bacillus leprae, the bacillus of glanders (Actinobacillus mallei), yeast and fungus. They did not yield any of the organisms. Special

anaerobic cultures were made, and special mediums were used for the growing of fungi; they also gave negative results.

The treatment in the hospital consisted of rest, a high caloric diet, a high intake of vitamins and administration of iron. The local treatment to the nose consisted of irrigation, application of hot boric compresses, packing of the wound with staphylococcus phage, packing off of the nasal cavity and filling of the wound with sodium perborate powder and a similar treatment with urea crystals. Large doses of potassium iodide were given without improvement, and this therapy was therefore discontinued. It was followed by treatment with sulfanilamide, which was given for nineteen days and which the patient tolerated well. Subcutaneous injections of staphylococcus phage were given.

It is interesting to note that after the administration of sulfanilamide streptococci in the smears were fewer and were difficult to culture. The hospital course was progressively downhill in spite of excellent care. The patient's condition was mildly septic, as evidenced by the temperature chart (fig. 3).

His appetite remained good. He felt equal to being up and about a little each day and was allowed bathroom privileges. The action of the bowels was regular. On March 8 he became nauseated. There was some abdominal distention with evidence of intestinal obstruction. On the following day his temperature rose to 106 F., and he died, apparently from acute intestinal obstruction. Permission for a postmortem examination was refused, but removal of some of the tissue about the lesion was permitted. This was studied by the pathologist, but a diagnosis could not be made.

CASE 4.—On Jan. 30, 1939, a man aged 36 years, a worker in a chemical plant, was referred to the outpatient department of the University Hospital, Ann Arbor, Mich., by Dr. M. H. Pike. His past history has two points of interest: He was a worker in a chemical factory and was exposed to toluene. In July 1937 he had experienced stuffiness of his nose, for the relief of which submucous resection of the nasal septum was done, with apparently complete healing.

In September 1938 he was treated for postnasal discharge, cough and crusting in the nose. In spite of treatment these symptoms became progressively worse. On Jan. 31, 1939 a general examination gave entirely negative results. He was apparently healthy. Both nasal chambers were filled with hard crusts, which could be removed only by nasal packing and frequent irrigations. When the crusts were removed, the membranes of the turbinates and septum were found to be largely destroyed. Under observation and treatment, which will be mentioned later, the lesion gradually progressed, so that by March 16, the turbinates had been completely destroyed, ulceration occurred on the hard palate, with perforation into the mouth, and there were marked redness, swelling and tenderness on the left cheek, with fluctuation in an area over the inner canthus of the left eye. By this time the patient's temperature had reached 104 F., and he was admitted to the hospital. However, hospital care did not alter the progress of the lesion. The cellulitis of the face subsided, leaving a small draining sinus over the lacrimal sac, and within a month the ulcer of the hard palate tripled in size. The borders remained elevated and indurated, with surrounding hyperemia. During the first week of May the right cheek became swollen. This was followed by erosion of the granuloma through the cheek and the base of the nose, so that by the latter half of May an opening 1 by 3 cm. was present, through which was seen the destroyed bone of the maxilla. The

hard palate had been entirely destroyed, and many teeth had become loosened from the alveoli and had fallen out of the right upper jaw. During the third month of hospitalization the necrosis continued to extend to the cheek and the orbit, in the nose and the oral cavity and across to the left cheek. During this time the patient had an irregular septic temperature and there were gradual wasting of the tissues of his entire body and emaciation.

Diagnostic studies were carried out, and many blood counts were made, without evidence of dyscrasia. Leukocyte counts ranged from 8,000 to 17,000. The differential counts were always within normal limits. The hemoglobin content varied from 65 to 92 per cent. On four occasions studies of the blood for syphilis gave negative results. Five biopsies were made, which showed marked inflammatory infiltration by lymphocytes and a large number of neutrophils. There were many new blood vessels with high endothelium. The mucous glands showed some atypical hyperplasia. There were no tubercles or evidence of neoplasm. Extensive necrosis was present. A definite diagnosis other than that of an infectious granuloma was not possible from study of the biopsy specimens.

Cultures and smears were negative for fungous infection. On February 2 a few acid-fast organisms were found, but inoculation of guinea pigs gave negative results. Further smears did not show acid-fast organisms, and cultures were negative for the diphtheria bacillus. Agglutination tests for Brucella and for organisms of the typhoid group were negative. Blood cultures were negative. The tuberculin test was negative when a 1:10,000 solution was used and faintly positive when the dilution was 1:100. Consultations were held with members of the medical, general surgical, urologic, dermatologic, neurologic and radiologic departments of the University of Michigan Medical School. The case was closely followed by members of the departments of dermatology and medicine, who gave frequent general examinations.

A high caloric diet was provided and a high intake of vitamins insured. In April two blood transfusions were given, and during the last three weeks of his stay in the hospital the patient was maintained on fluids.

Immediately after he was admitted to the hospital, roentgen radiation (900 roentgens) was applied to the ulcer in the roof of the mouth, which seemed to hasten the necrosis. Therefore, further roentgen treatment was not given. Local treatment consisted of irrigations with potassium permanganate, cleansing with sodium perborate and hydrogen peroxide, packing with zinc oxide and packing with bacteriophage, all without apparent improvement. Therapeutic tests with a bismuth compound and arsphenamine were made, also without effect. This was followed by a course of sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) therapy, again without response.

On June 22 the patient was discharged from the hospital by ambulance, and on June 29 he died. Necropsy showed chronic myocarditis, old healed endocarditis, chronic hepatitis, congestion of all the organs, marked dehydration, terminal suppurative pneumonia and cellulitis of the face involving both the right and the left cheek, with extensive necrosis and erosion, and destruction of all the bones of the upper jaw and nose.

COURSE OF THE DISEASE

The onset of a granulomatous ulcer is most insidious, and for several months or even years before ulceration develops, the patient may com-

plain only of nasal congestion, nasal obstruction or watery discharge from the nose. Otherwise he feels quite well. He may seek relief for nasal obstruction or discharge. In case 1, headaches were a predominant symptom. The septum may be straightened (case 4) and the turbinates either removed (case 3) or cauterized (cases 1 and 5) for the relief

TABLE 1.—*Data on Patients with Granulomatous Ulcer*

					Variation †					
Case	Age and Sex	Date of Onset	Duration, Mo.	Previous Surgical Treatment	Pulse Rate	Temperature, F.	Respirations per Min.	Hemoglobin Content of Blood, per Cent	Leukocyte Count	Outcome
1	51 M	11/35	11	Cauterization of turbinate	80 to 100	98 to 106	20 to 40	73 to 60	5,600 to 12,600	Death from hemorrhage
2	35 M	2/37	9	None	70 to 125	98 to 104	20 to 28	80 to 64	9,100	Death from sepsis
3	57 M	4/37	11	Turbinectomy	70 to 140	97 to 106	18 to 36	80 to 66	10,000 to 14,000	Death from intestinal obstruction
4	36 M	7/37	24	Submucous resection	85 to 150	98 to 104	20 to 32	92 to 66	8,000 to 17,400	Death from inanition, athrepsia and sepsis
5*	40 F	10/38	24	Electrocoagulation; biopsy	70 to 100	97 to 100	20	66 to 80	9,800	Patient living and well

* This case was atypical.
† In all 5 cases the differential count was normal for infections. In cases 1, 2, 3 and 4 the urine was normal; in case 5 there were a few leukocytes. In all cases the biopsy specimen showed acute and chronic inflammation.

TABLE 2.—*Diseases to Be Excluded in Differential Diagnosis*

1. Syphilis	8. Glanders
2. Tuberculosis	9. Anthrax
3. Malignant disease	10. Myiasis
4. Noma	11. Postencephalitic ulcer (trophic)
5. Fungous infections	12. Leishmaniasis
6. Agranulocytosis	13. Yaws
7. Leprosy	14. Diabetic gangrene

These diseases are ruled out by laboratory procedures, therapeutic tests and clinical course.

of the obstruction; the nose may or may not heal from the surgical trauma. Over a period of a few months the nasal symptoms become progressively worse, the obstruction cannot be relieved and the discharge becomes serosanguineous, brown or purulent, with a disagreeable odor. Crusts then form, which are difficult and painful to remove. When the crusts are removed, ulcerative surfaces are exposed and slight bleeding occurs.

It is remarkable that this process may be present for a few months with little general reaction on the part of the patient. He may feel quite well and be without pain. On the other hand, pain and headaches may be marked symptoms. Usually the removal of the crusts causes pain and pain is a more troublesome symptom during the late course of the disease.

The disease progresses with baring and necrosis of the bone in the nose. The external tissues of the nose and face become reddened and indurated, and finally a gangrenous ulcer appears on the external surface. An abscess related to the lacrimal sac may form and drain. This occurred in cases 2 and 4. Similarly, abscesses which drain or require drainage may form on the palate and the alveolar margin in the oral cavity. The exposed bone may sequestrate, and the teeth in the involved area may become loosened and fall out (case 4).

During this active ulcerative stage there may be a mild or even a severe septic temperature, which tends to rise with time; it varies from normal to 105 or 106 F. Rigors, or chills, were frequent in case 1 but rare in the remaining cases. The patient, however, feels better than one would expect. If the area of an artery is eroded, a troublesome hemorrhage may take place and packing or ligation of vessels will be required. In case 1 death resulted from hemorrhage. The gangrenous granulomatous area spreads, and marked multilation may occur over large areas(case 4). The temperature usually remains elevated. The patient may have difficulty in taking nourishment. Fluid may be given parenterally or by tube. The patient finally succumbs to terminal pneumonia, toxemia, inanition or hemorrhage. The entire course of the disease may cover a period of from six months to two or three years (table 1).

CAUSATION AND DIAGNOSIS

Since the cause is unknown, any discussion of the subject is mere conjecture. The more common causes of other such progressive ulcerations are tuberculosis, syphilis, new growths, fungous infections, leprosy and glanders (table 2). In all the cases reported here, these were excluded by laboratory and therapeutic tests.

Schütz reported 6 cases of what was apparently granulomatous ulcer. In 2 of these lymphosarcoma was found at autopsy, with metastasis to the kidney in one and with metastasis to the intestinal tract in the other. Schütz stated that it would be easy for a real tumor to be erroneously diagnosed as malignant granuloma. However, if examination of the blood shows mild leukopenia, with a marked "shift to the left" in the differential count, one can be certain of the presence of malignant granuloma. In some of the cases reported by Schütz there was a mod-

erate increase in the leukocyte count. In lymphosarcoma the leukocyte count is over 11,000 and there is not the "shift to the left," even though there is no increase in lymphocytes.

The most common organisms found in fatal granulomatous ulcers are Streptococcus, Staphylococcus and the pseudodiphtheria bacillus. Because these organisms do not ordinarily produce progressive gangrenous granulomatous ulcers such as those described, it has been suggested that there is a symbiosis between them, with the production of a necrotizing substance capable of such destruction.

Stewart quoted the theory of Brewer and Meleny that there is a symbiosis between the staphylococci and the streptococci, while Joisten suggested that there is a symbiosis between the pseudodiphtheria bacillus and other organisms. To date the isolation of organisms from granulomas and the injection of such organisms into experimental animals have failed to reproduce progressive gangrenous granuloma.

Wegener concluded from his postmortem studies that streptococci may well play some part in the causation of this condition, since his patients showed generalized tissue changes characteristic of severe infection. He also observed marked periarteritis nodosa and expressed the opinion that the causes of the two conditions might be related. He stated further that periarteritis nodosa was found in virus diseases, such as Rocky Mountain spotted fever, and that a virus might be the etiologic factor in fatal granulomatous ulcer.

In the department of pathology at the University of Michigan Medical School, it was suggested that the etiologic factor in case 4 might be a chemical injury, since the patient was a worker in a chemical factory. There was a question also as to the possibility that the lesion represented the Arthus phenomenon.

The spontaneous cure noted by Schütz and the apparent cure in a case similar to his now under my observation suggest an unknown etiologic factor with secondary invasion by pyogenic organisms.

Age and Sex.—This disease is most common in young adults and middle-aged persons. It has been reported in persons from 11 to 68 years old. Only 2 cases have been reported in which the patients were children. The sex ratio is about 20 males to 1 female.

PATHOLOGY

The following description of the microscopic section from the granuloma in case 4 was given by Dr. Shields Warren:

On the border of the lesion is an amorphous mass of necrosis, beneath which there is infiltration by inflammatory cells, chiefly lymphocytes and macrophages.

with occasional plasma cells. A few polymorphonuclear leukocytes are also present. There is some new formation of capillaries. The larger vessels in the tissue show a definite perivascular cuff of lymphocytes and macrophages, with degeneration of the arterial walls in some regions. While there are focal accumulations of the infiltrating cells in the tissues, the lesion is not characteristic of tuberculosis, syphilis or leprosy. Diagnosis: chronic granuloma, cause unknown.

The same description applies to the section examined in case 3.

Since case 5 is atypical and the patient apparently is recovering, I am also giving Dr. Warren's description of two sections of tissue from the lesion in this case:

Section 1 shows infiltration of the tissues with close packed lymphocytes, macrophages and rare plasma cells. Occasional polymorphonuclear leukocytes are present. There is considerable new capillary formation, and there tends to be focal accumulation of the cells about the vessels. Rarely, multinucleate giant cells are seen. In section 2 the mucous membrane is heavily infiltrated by lymphocytes, macrophages and some plasma cells, often diffusely scattered, sometimes focal, with rare multinucleate giant cells. New formation of capillaries and some fibroblastic proliferation are apparent. Around some of the vessels there is a distinct perivascular aggregation, with occasional arteritic infiltration of vascular walls. Some portions of the mucous membrane show pseudotuberculous aggregations of macrophages and lymphocytes, with slight peripheral fibrosis. Neither tubercle bacilli nor lepra bacilli were found. Diagnosis: chronic granuloma, cause unknown.

In Wood's case report, the opinions of Dr. Eugene A. Case, Dr. Joseph McFarland, Dr. James Ewing and Dr. Frederick D. Weidman were given concerning the pathologic changes observed microscopically. Certainly I am unable to add anything new.

PROGNOSIS

As indicated by the title of this paper, the prognosis usually is hopeless, yet the patient in case 3 had a granuloma in 1915, from which he recovered. Schütz mentioned a spontaneous cure in a case in which the granulation tissue could not be differentiated from that in cases in which the disease was progressive and resulted in death. Stewart recorded the cases of 2 patients who did not die as the immediate result of granuloma.

I have under treatment at present a woman of 40 (case 5) with a granuloma of the nose (figs. 4 and 5), who has had symptoms for eighteen months and who had been carefully examined by competent physicians in two large clinics. All laboratory tests, including biopsy, had been done without establishing the etiologic factor. While the patient was under my observation, the granuloma eroded through the dorsum and the lateral nasal wall at the junction of the upper lateral

cartilages and the nasal bone, lifting the skin upward. The granulomatous area was removed by dissection, the patient was given antisyphilitic treatment and apparently a cure has resulted. I cannot say that the syphilitic treatment has produced a cure, for repeated blood tests elsewhere and at this clinic have been negative, and the history is not even suggestive of syphilis.

Cases such as this suggest that the defense mechanism of the body, at least in some cases, is capable of overcoming the etiologic factor, whatever it may be.

Fig. 4 (case 5).—Raised area of skin over the granuloma, April 16, 1940.

Fig. 5 (case 5).—The patient on Sept. 10, 1940, following administration of iron, high intake of vitamins and antisyphilitic therapy.

TREATMENT

There is no specific treatment. Surgical excision has been disappointing. Bayer's removal by electrocoagulation gave only a temporary cleansing of the area. Roentgen radiation has given temporary improvement of early lesions and was helpful in case 3. Stewart recommended roentgen treatment. This was used for his patient who recovered from the granuloma. In the more advanced stages of the disease roentgenotherapy is of no value and seems to hasten necrosis (case 4).

Sulfanilamide and its derivatives have not controlled the disease in cases in which they have been used. In case 3 sulfanilamide apparently

decreased the number of streptococci but did not stop the progress of the lesion. Numerous antiseptics have been employed, all with equally poor results. Staphylococcus seems to have no effect (table 3).

If I had a patient with granulomatous ulcer at the present time, I should solicit the aid of the staff of a research laboratory, which has facilities for the study of viruses and for bacteriologic research, in investigating the etiologic factor. I should enlist the cooperation of an internist in keeping the patient in a good state of general nutrition and in supplying all supportive measures possible. I should keep the wound clean by the local use of bland washes and should pack it with sulfathiazole (2-[paraaminobenzenesulfonamide]-thiazole) powder. I should give some of the sulfanilamide derivatives internally, and I should also use roentgenotherapy.

TABLE 3.—*Means of Treatment*

Case	Anti-syphilitic Drugs	Roentgen Rays	Sulfanilamide	Potassium Iodide	Staphylococcus Phage	Blood Transfusions	Urea	Sodium Perborate	High Intake of Vitamins
1	+	0	0	+	0	+	0	0	+
2	+	0	0	+	0	0	+	+	+
3	+	+	+	+	+	0	0	0	+
4	+	+	+	+	+	+	+	+	+
5*	+	..	..	..	..	..	..	..	+

* This case was atypical.

SUMMARY

The literature on granulomatous ulceration of the nose and face is reviewed. Four new cases of this condition in which the clinical course was fairly typical are reported, together with a fifth case, which is atypical. Granulomatous ulcer of the nose and face apparently constitutes a disease entity of unknown causation, for which at present there is no adequate treatment.

It is my hope to stimulate further interest in the search for the etiologic factor in this disease. Since I have been able to collect 4 cases from the practice of my acquaintances, this condition is apparently much more common than the report of only 2 cases in the American literature would indicate.

Case 1 is reported by permission of Dr. C. D. Knowlton, case 2 by permission of Dr. LeRoy A. Schall and Dr. J. C. Drooker and case 4 by permission of Dr. A. C. Furstenberg and Dr. F. D. Lathrop.

FENESTRA NOV-OVALIS

A NEW OVAL WINDOW FOR THE IMPROVEMENT OF HEARING IN CASES OF OTOSCLEROSIS

JULIUS LEMPERT, M.D.
NEW YORK

Practical, serviceable physiologic hearing of air-borne sound can be surgically restored to the deafened person by fenestrating the external semicircular canal with the technic which I [1] have described, and the improvement, once obtained, can be maintained postoperatively provided:

1. That the fenestration operation is performed in a properly selected case of deafness.

2. That complete or partial closure of the newly created fenestra as a result of osteogenesis or fibrosis does not take place. The fenestra must remain widely patent.

After having performed 375 fenestration operations and observed and studied the end results, I am convinced that fenestration of the labyrinth is indicated only in those cases in which air conduction deafness has resulted from stapedial fixation and degeneration of the cochlear nerve has not yet produced impairment of hearing for the conversational frequencies 512, 1024 and 2048. I am equally convinced that desirable late end results cannot be obtained in such cases unless simultaneously there are a normal and completely intact drum membrane, a patent eustachian tube and complete absence of middle ear infection.

In a patient presenting this composite picture, stapedial fixation due to otosclerosis can, as a rule, be diagnosed preoperatively.

S. L., aged 47, who presented the aforementioned preoperative clinical picture, died of coronary thrombosis fourteen days after undergoing a Lempert fenestration operation. Photomicrographs of his sectioned temporal bone showing stapedial fixation due to otosclerosis are presented in figures 1, 2 and 3.

In 300 of the 375 cases in which I operated for this form of deafness during the last three and a half years, I fenestrated the external semi-

Read before the Section on Otolaryngology at the Centennial Meeting of the State Medical Society of Wisconsin, Madison, Wis., Sept. 11, 1941.

1. Lempert, J.: Improvement of Hearing in Cases of Otosclerosis: A New One Stage Surgical Technic, Arch. Otolaryng. **28**:42 (July) 1938.

Fig. 1.—Photomicrographs of sectioned temporal bone. *A* shows otosclerosis on either side of the oval window niche. The line of demarcation between the normal bone and the otosclerotic bone is seen. *B* (high power) shows the line of demarcation between normal and otosclerotic bone.

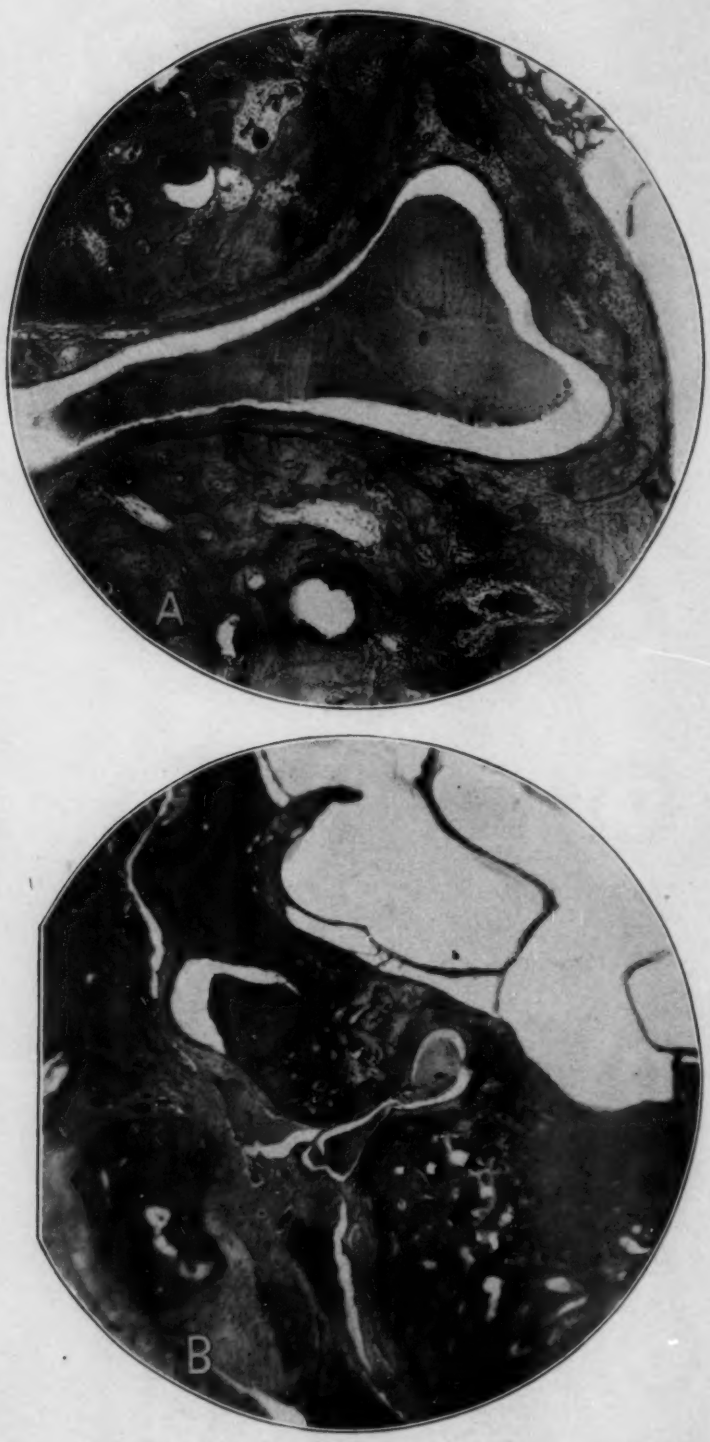


Fig. 2.—Photomicrographs of sectioned temporal bone. *A* (high power) shows the otosclerotic area and the footplate of the stapes. *B* shows ankylosis of the footplate of the stapes.

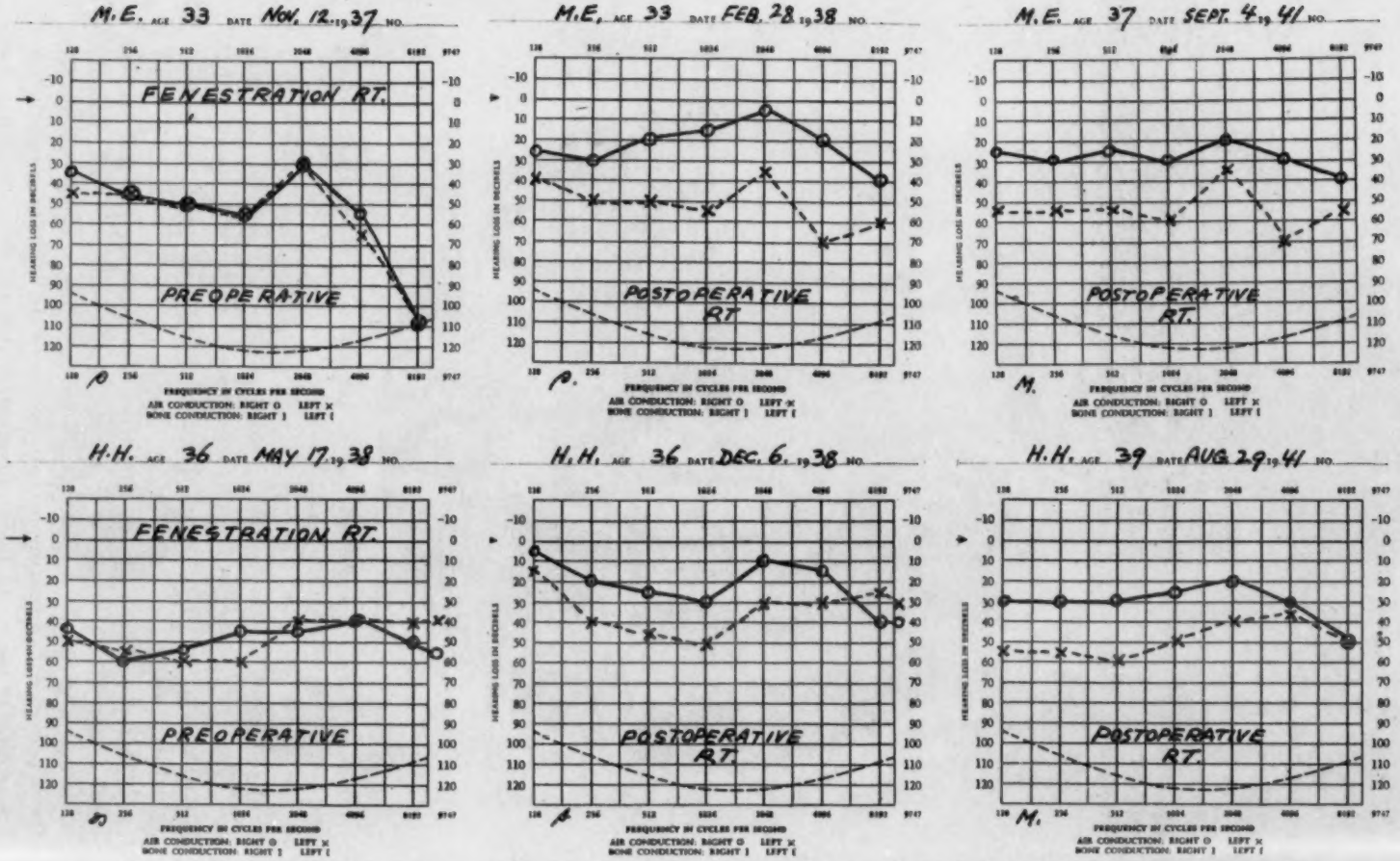
circular canal, employing the one stage endaural fenestration technic, in an attempt to restore practical hearing and to maintain this hearing postoperatively.

In figures 4 to 8 audiograms are submitted as proof that by fenestration of the external semicircular canal with this technic hearing can be restored in properly selected cases of otosclerosis to the level necessary for social and economic purposes and can be maintained at that level indefinitely when the newly created fenestra remains widely open.

Fig. 3.—High power photomicrograph of sectioned temporal bone, showing ankylosis of the stapedial footplate.

In 88 of the 300 instances in which the external semicircular canal was fenestrated, the newly created fenestra eventually closed either partially or completely. The interval between operation and closure varied from two to five months.

In 212 cases the newly created fenestra in the external semicircular canal remained widely patent. Though it must be admitted that this evidenced a great advance in the evolution of the surgical technic for the improvement of hearing by fistulization of the labyrinth, and though I was able to point out to my prospective patients that the chance for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FENESTRATION RT.
PREOPERATIVE
M. E. AGE 33 DATE FEB. 28, 1938 NO.
POSTOPERATIVE RT.
M. E. AGE 37 DATE SEPT. 4, 1941 NO.
POSTOPERATIVE RT.
H. H. AGE 36 DATE MAY 17, 1938 NO.
FENESTRATION RT.
PREOPERATIVE
H. H. AGE 36 DATE DEC. 6, 1938 NO.
POSTOPERATIVE RT.
H. H. AGE 39 DATE AUG. 29, 1941 NO.
POSTOPERATIVE RT.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 4.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients M. E. and H. H.

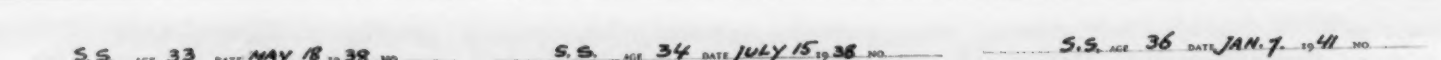
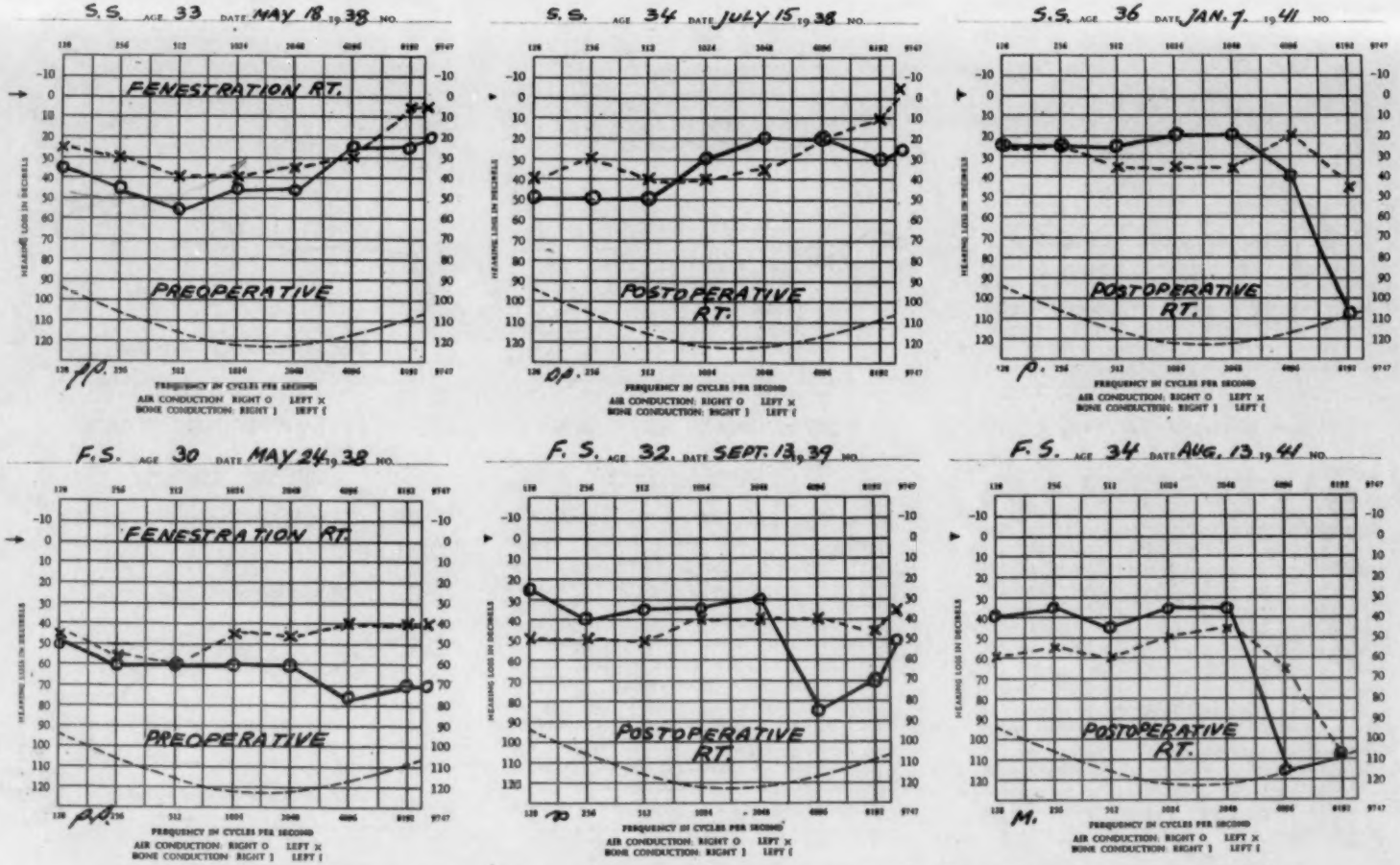


Fig. 4.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients M. E. and H. H.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POSTOPERATIVE RT.
F.S. AGE 30 DATE MAY 24 1938 NO.
FENESTRATION RT.
PREOPERATIVE
F.S. AGE 32 DATE SEPT. 13 1939 NO.
POSTOPERATIVE RT.
F.S. AGE 34 DATE AUG. 13 1941 NO.
POSTOPERATIVE RT.
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 5.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients S. S. and F. S.

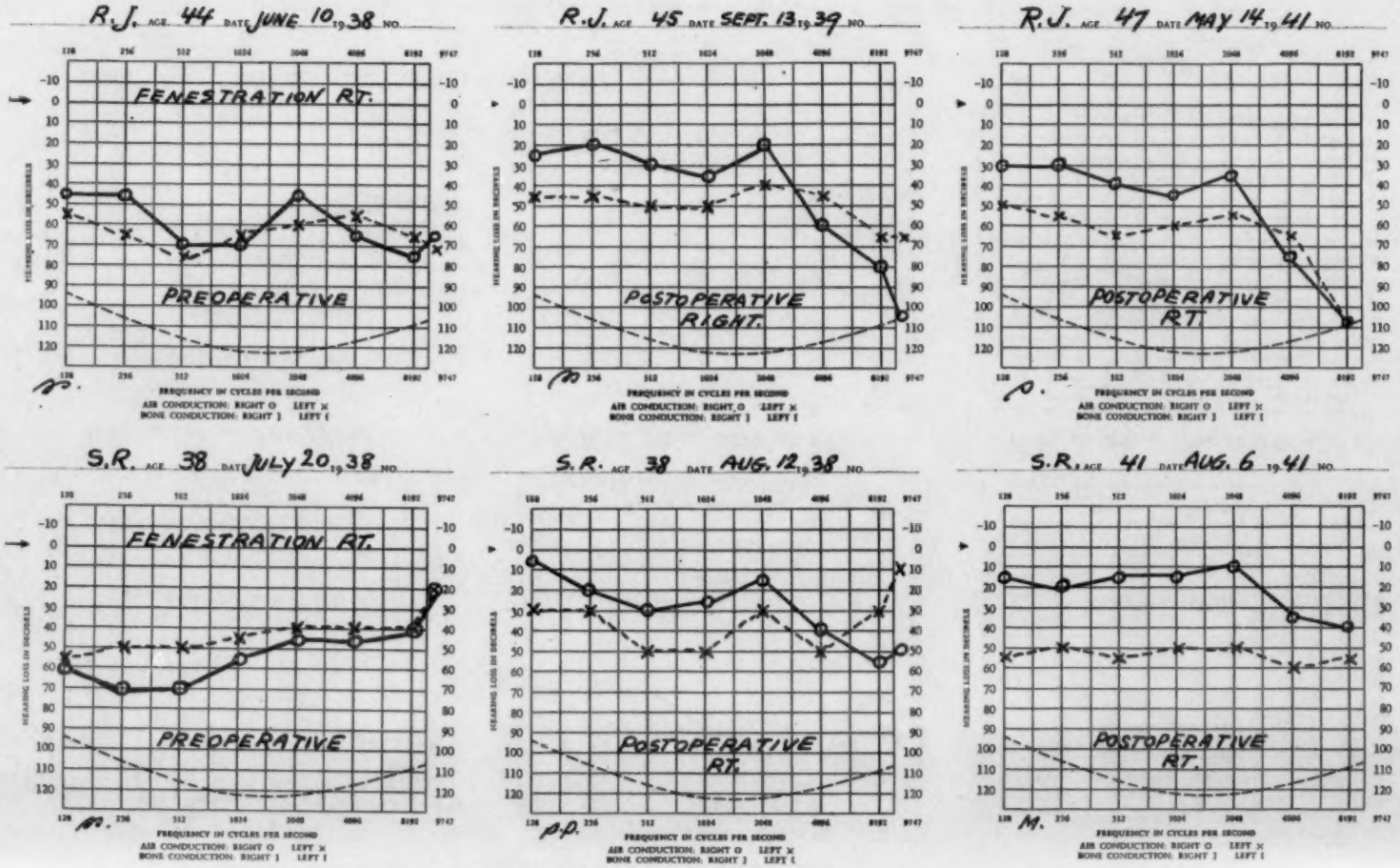
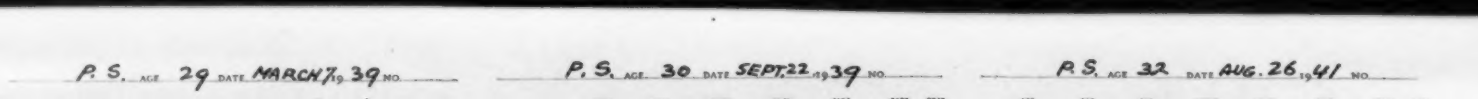
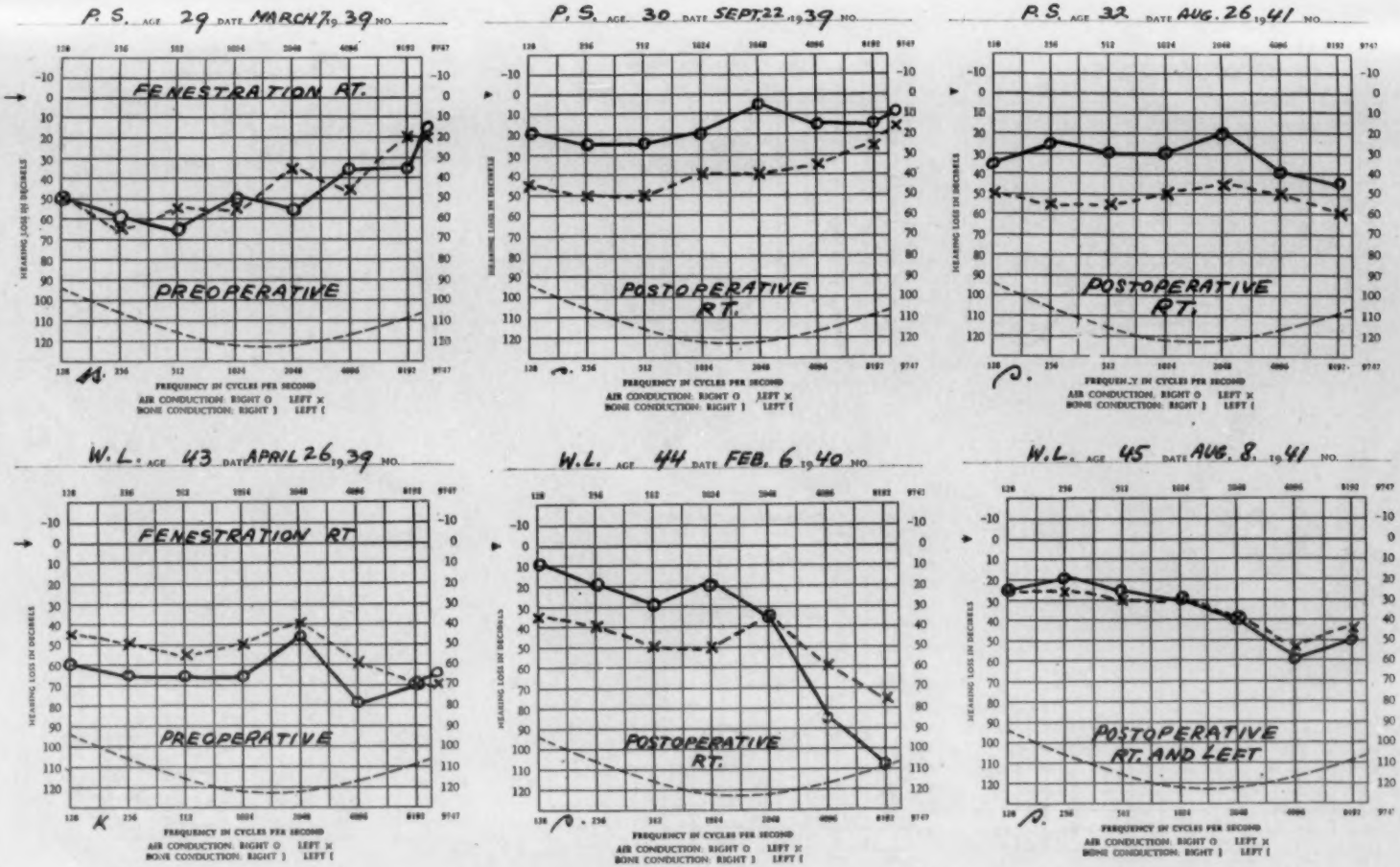

R. J. AGE 44 DATE JUNE 10, 1938 NO.
FENESTRATION RT.
PREOPERATIVE
R. J. AGE 45 DATE SEPT. 13, 1939 NO.
POSTOPERATIVE RIGHT.
R. J. AGE 47 DATE MAY 14, 1941 NO.
POSTOPERATIVE RT.
S. R. AGE 38 DATE JULY 20, 1938 NO.
FENESTRATION RT.
PREOPERATIVE
S. R. AGE 38 DATE AUG. 12, 1938 NO.
POSTOPERATIVE RT.
S. R. AGE 41 DATE AUG. 6, 1941 NO.
POSTOPERATIVE RT.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 6.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients R. J. and S. R.

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POSTOPERATIVE RT.
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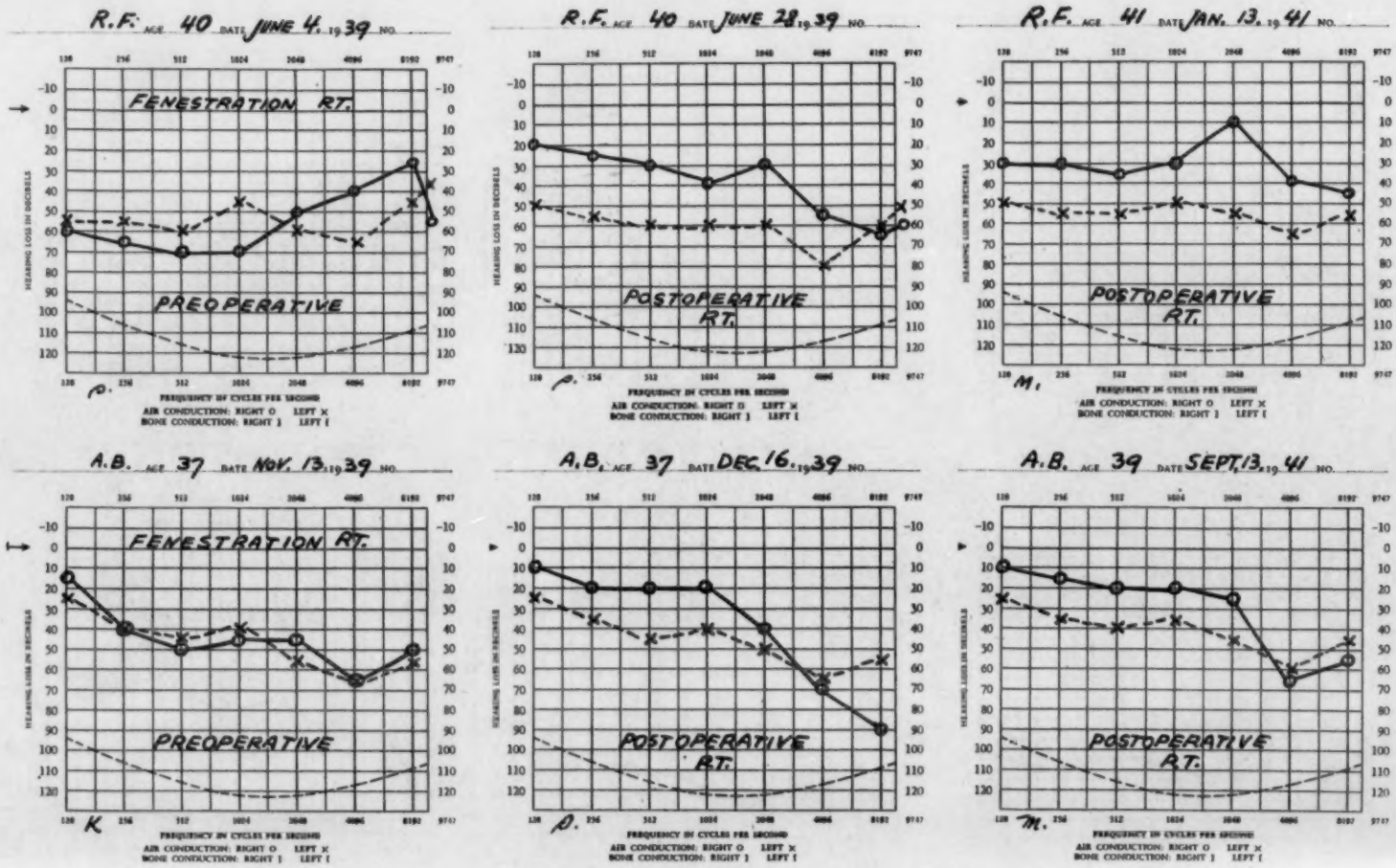
POSTOPERATIVE RT.
W. L. AGE 43 DATE APRIL 26, 19 39 NO.
FENESTRATION RT.
PREOPERATIVE
W. L. AGE 44 DATE FEB. 6, 19 40 NO.
POSTOPERATIVE RT.
W. L. AGE 45 DATE AUG. 8, 19 41 NO.
POSTOPERATIVE RT. AND LEFT
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 7.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients P. S. and W. L.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FENESTRATION RT.
PREOPERATIVE
R.F. AGE 40 DATE JUNE 28, 1939 NO.
POSTOPERATIVE R.T.
R.F. AGE 41 DATE JAN. 13, 1941 NO.
POSTOPERATIVE R.T.
A.B. AGE 37 DATE NOV. 13, 1939 NO.
FENESTRATION RT.
PREOPERATIVE
A.B. AGE 37 DATE DEC. 16, 1939 NO.
POSTOPERATIVE R.T.
A.B. AGE 39 DATE SEPT. 13, 1941 NO.
POSTOPERATIVE R.T.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 8.—Late hearing improvement resulting from fenestration of the external semicircular canal in patients R. F. and A. B.

Fig. 9.—Photomicrographs of sectioned temporal bone. In *A* the inner surface of the tympanomeatal membrane covering the external semicircular canal fenestra appears to be epithelium lined. In *B* (high power) the epithelium-lined surface of the tympanomeatal membrane is seen.

the newly created fenestra in the horizontal canal to remain permanently open was overwhelmingly in their favor, I nevertheless always felt uneasy about predicting favorable end results with any measure of assurance in any particular case. The reason for this uncertainty was that at no time did I know what, if anything, happened to precipitate closure in the 88 cases in which closure occurred and therefore I never knew how to try to avoid such an occurrence. It was this unhappy state of my mind, resulting from the uncertainty connected with so important a surgical procedure, on which so great a stake—namely, the patient's hope for social and economic rehabilitation—depended, that forced me to search constantly for an explanation of the closure of 88 fenestrae in my series of 300. I was hopeful that by finding the underlying cause of the closure I should in turn better understand my successful end results and perhaps by deduction succeed in finding a definite way of making a fenestra which would always remain open.

In attacking this research problem I followed two separate lines of investigation:

1. The natural tendency of bone after injury being toward repair, why did a newly created fenestra in the external semicircular canal remain open in 212 of 300 cases?

Never having been able to reconcile myself to the belief that the inherent biologic tendency toward the formation of new bone in my series of 300 cases differed greatly from, or was any less than, that in any large series in which results from operations performed by other methods were reported, I could not explain on this basis my higher percentage of cases in which the new window remained patent. I therefore had to assume that the technic employed held the key to the prevention of bone regeneration in these 212 cases.

This technic embraces technical factors which I believe are capable of inhibiting the formation of new bone in a newly created fenestra. Though the dull polishing burr and the gold burnishing burr employed in the fenestration of the bony capsule of the external semicircular canal in an endeavor to seal the haversian canals within the freshly cut fenestra walls were never experimentally proved capable of preventing bone regeneration, there nevertheless is some experimental proof that these burrs delay osteogenesis.

The careful removal of the endosteum and the shaving of the inner endosteal cambium layer underneath the inner margins of the bony walls of the fenestra were practiced in order to inhibit osteogenesis, because these tissues have been proved experimentally by such observers as Bast, Sullivan and Geist [2] to be active agents in the production of

2. Bast, T. H.; Sullivan, W. E., and Geist, F. D.: The Repair of Bone, Anat. Rec. **31**:255 (Nov.) 1925.

new bone. Believing that the formation of new bone could be discouraged by covering the fenestra with the epithelium-lined surface of a membrane facing the periosteal layer of the bony fenestral walls, I endeavored to cover the fenestra with Shrapnell's membrane in every case. Figure 9 presents photomicrographs of the sectioned temporal bone removed from S. L., suggesting that Shrapnell's membrane did cover the fenestra in this particular case. Finally, since I had observed long ago that the greatest stimulus to closure of a new window by newly formed bone is excessive postoperative inflammatory reaction of the tissues involved in this operation, I employed the endaural antauricular approach, which results in a minimum of postoperative reaction of the tissues. With this approach, less tissue is traumatized and sacrificed than with the combined postauricular-endaural approach.

Though there is no experimental proof that the technical factors which I employ and advocate for the prevention of new bone formation are capable of accomplishing this result either individually or collectively, I have nevertheless obtained continuous patency in the newly created fenestra in the external semicircular canal in a much larger percentage of cases with my technic than has ever been reported with any other technic.

Photomicrographs of the sectioned temporal bone removed from S. L. two weeks after operation (figs. 10 and 11) suggest that this technic inhibits the natural tendency toward bone regeneration within the bony walls of a newly created fenestra.

2. I had fenestrated 300 external semicircular canals with a technic which was conceived to prevent repair and closure of a newly created fenestra and which I believe was responsible for 212 of the newly created fenestrae remaining open. Why did the other 88 fenestrae close?

Believing, as I did, that the 212 fenestrae which remained open did so mainly because the technic employed to create them and the meticulous care exercised in the execution of this technic prevented their closure, I found the 88 closures which had taken place—despite the fact that the same technic and the same care were employed in all the 300 cases—embarrassing and difficult to explain.

An investigation of the closed fenestrae in order to find the key, if possible, to the explanation of closure was therefore undertaken.

INVESTIGATION OF CLOSED FENESTRAE

I reoperated in 72 of the 88 cases in which there was clinical evidence of closure of the newly created fenestra in the external semicircular canal and carefully observed and studied the gross findings in every one of the fenestrae.

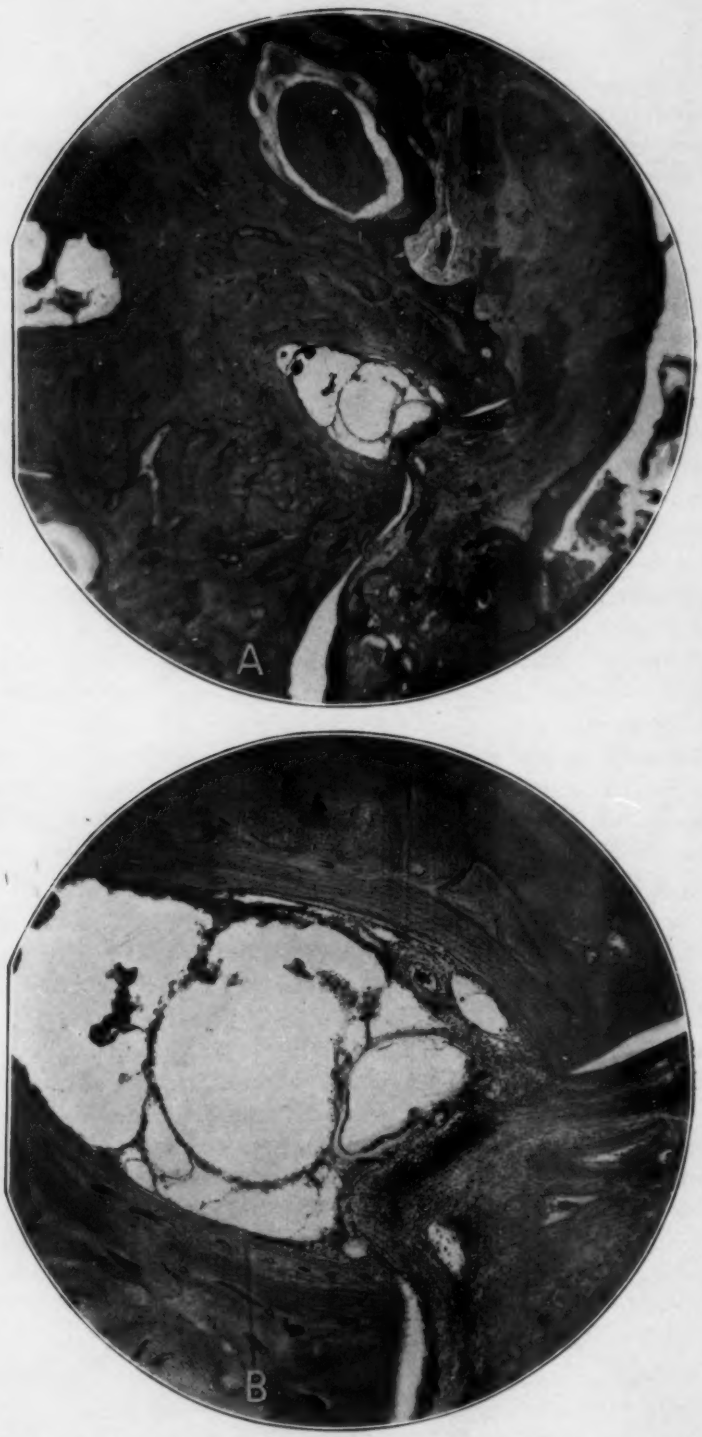

Fig. 10.—Photomicrographs of sectioned temporal bone. *A* shows the newly created fenestra in the external semicircular canal. There is complete absence of bone regeneration. *B* (high power) shows the fenestra in the external semicircular canal widely patent. There is no new bone formation.

Fig. 11.—High power photomicrographs of sectioned temporal bone. In *A* the anterior bony wall of the fenestra in the external semicircular canal is seen. There is complete absence of bone regeneration. In *B* the posterior bony wall of the fenestra in the external semicircular canal is seen. There is complete absence of new bone regeneration.

Two distinct types of closure were observed:

1. *Closure by Bone Regeneration.*—When the fenestra in the external semicircular canal was made through the bony capsule, down to the endosteum, without removal of the fibrous endosteal membrane, closure of the fenestra took place very rapidly in the vast majority of the cases. Such a fenestra always closed by the formation of new bone. When such a fenestra was inspected early after closure, a newly formed thin bony lid was seen to have extended from the inner cambium layer of the bony lateral walls of the fenestra across the entire fenestral floor covering and to become attached to the endosteum. If this bony lid was not removed and the fenestra was again inspected several months later, the newly formed bone was seen to have grown from within outward to fill the entire fenestral space and to reach and involve the outer periosteal layer of the bony capsule. The bony closure of such a fenestra was always complete, regardless of whether the fenestration was begun posterior to or over the ampulla.

2. *Closure by the Formation of Fibrous Connective Tissue.*—When in fenestration of the external semicircular canal the endosteum was removed to expose the endolymphatic labyrinth within the perilymph space and the endosteal cambium layer of the inner margins of the bony fenestra was shaved, the fenestra usually remained open. Whenever such a fenestra closed, it did so very slowly. Inspection of this type of closure during the early stages always revealed the presence of fibrous connective tissue within the perilymphatic space. The fenestral walls in the bony capsule proper showed no signs of newly formed bone. If this fibrous connective tissue was left untouched and the fenestra was again inspected several months later, the fibrous connective tissue mass was observed to have grown outward from the perilymphatic space to fill the space between the bony walls of the fenestra. The connective tissue mass was more solid now, but not fixed. It appeared to have changed to hyalinized connective tissue. If this was left untouched and viewed again several months later, it was seen to have reached still farther outward, filling the fenestra as far as the outer boundary of the periosteal layer of the bony walls. It was more fixed than when seen before but was not united with the bony walls of the fenestra. It now had the appearance of having become calcified and of undergoing bony metaplasia.

Some closures of this kind were found to be complete; others, incomplete. Every one of the complete closures which were observed to have taken place as a result of bony metaplasia of fibrous connective tissue occurred in a case in which fenestration was begun posterior to the ampulla.

Every incomplete closure encountered was the result of bony metaplasia of fibrous connective tissue and occurred in a case in which the fenestration was begun over the ampulla. In these cases the connective tissue mass was observed to fill only that part of the perilymphatic space of the fenestra in the external semicircular canal which occupied a position posterior to the ampulla; it was never found in the ampulla proper. The permanent opening in these cases was always a very small one and invariably located in the region of the ampulla.

In every case in which closure of the fenestra was found to be incomplete, there was, prior to inspection of the fenestra, a positive fistula test, though the air conduction hearing, after having been improved by fenestration, had reverted to the preoperative level. This proves that a positive fistula test following fenestration is indicative of patency of the fenestra only when the improvement in hearing continues.

The minute permanent opening in the region of the ampulla observed in these cases, though sufficient to give a positive vestibular reaction, was not sufficient to permit that amount of mobilization of the perilymph by air-borne sound which could result in improved hearing.

In the attempt to analyze these findings within the closed fenestrae, the following question had to be answered. After one had done what was deemed necessary to prevent new bone formation arising from the endosteum, inner cambium layer, haversian canals and outer periosteal layer, and apparently with success, what was it that occurred in some cases which resulted in the growth of fibrous connective tissue in the perilymph space, a growth that acted as a nucleus for subsequent closure of the fenestra by bony metaplasia of the connective tissue mass, and why did that not take place more frequently?

I had observed long ago that when blood was permitted to enter the perilymph space at the time of operation and to remain there, the result was usually the formation of fibrous connective tissue within the perilymph space. It was for this reason that I never opened the perilymph space in the presence of even the most infinitesimal bleeding within the surgical wound. Great pains were taken also not to cover the fenestra with Shrapnell's membrane until it was ascertained that the perilymph space was free of blood and bone dust. It was for this same reason that the source of the fibrous connective tissue observed in these closures for a long time remained unexplained. I therefore decided to investigate this phase of the problem. In a series of 50 consecutive cases, after covering the newly created fenestra with the tympanomeatal membrane, I waited about ten minutes and then lifted the membrane from its position and uncovered the fenestra. In every one of these cases, to my surprise and chagrin, I found that blood had entered the perilymph space and already had formed a fibrinous film.

With no visible bleeding anywhere in the wound, this collection of blood within the perilymph space must have been of capillary origin. This at once convinced me that the entrance of blood into the perilymph space occurs to a greater or lesser degree in every case and that the occurrence is almost unavoidable.

Photomicrographs of the sectioned temporal bone removed from S. L. (figs. 12 and 13) show the presence of blood and fibrous connective tissue in the perilymph space two weeks after operation.

Accepting the entrance of some blood into the perilymph space as unavoidable, I was immediately faced with the question why closure of the fenestra as a result of connective tissue formation did not take place more often than it did in my series of 300 cases. The answer to that might depend on (1) the amount of blood which entered the perilymph space; (2) the size of the perilymph space, which could have favored the dissemination, absorption and elimination of accumulated blood within the space, or (3) the histologic structure of the inner surface of the membrane which covered the fenestrated perilymph space. A periosteum-lined inner surface of a membrane when pressed into the fenestra and placed in contact with a blood coagulum in the perilymph space of the external semicircular canal may confine the coagulum within this extremely narrow perilymph space and naturally stimulate the formation of fibrous connective tissue. However, an epithelium-lined inner surface of a membrane (like that of Shrapnell's membrane) coming in contact with a blood coagulum will not favor organization of the blood clot and its transformation into connective tissue.

On the basis of this theory, one could reason that since the circumference of the perilymph space within the external semicircular canal is only 0.8 mm. in the region posterior to the ampulla but twice that in the region of the ampulla, and since it is not likely that in some cases I did not succeed in covering more than the anterior ampullary end of the fenestra with Shrapnell's membrane and thus permitted the periosteum-lined surface of the cutaneous lining of the external auditory canal to cover the fenestra posterior to its ampullary end, the entrance of a small quantity of blood into the perilymph space of a fenestra which was begun over the ampulla would result in the formation of connective tissue within the perilymph space in the region posterior to the ampulla but not in the ampulla proper. Perhaps this is the reason why in all the partially closed fenestrae the bony metaplasia of the connective tissue resulted in closure only of the part of the fenestra occupying a position posterior to the ampulla, while the anterior part of the fenestra, which was in the region of the ampulla, was always found to have remained open.

Fig. 12.—Photomicrographs of sectioned temporal bone. *A* shows an accumulation of blood within the perilymphatic space of the fenestrated external semicircular canal. *B* (high power) shows an accumulation of blood within the perilymphatic space of the fenestrated external semicircular canal.

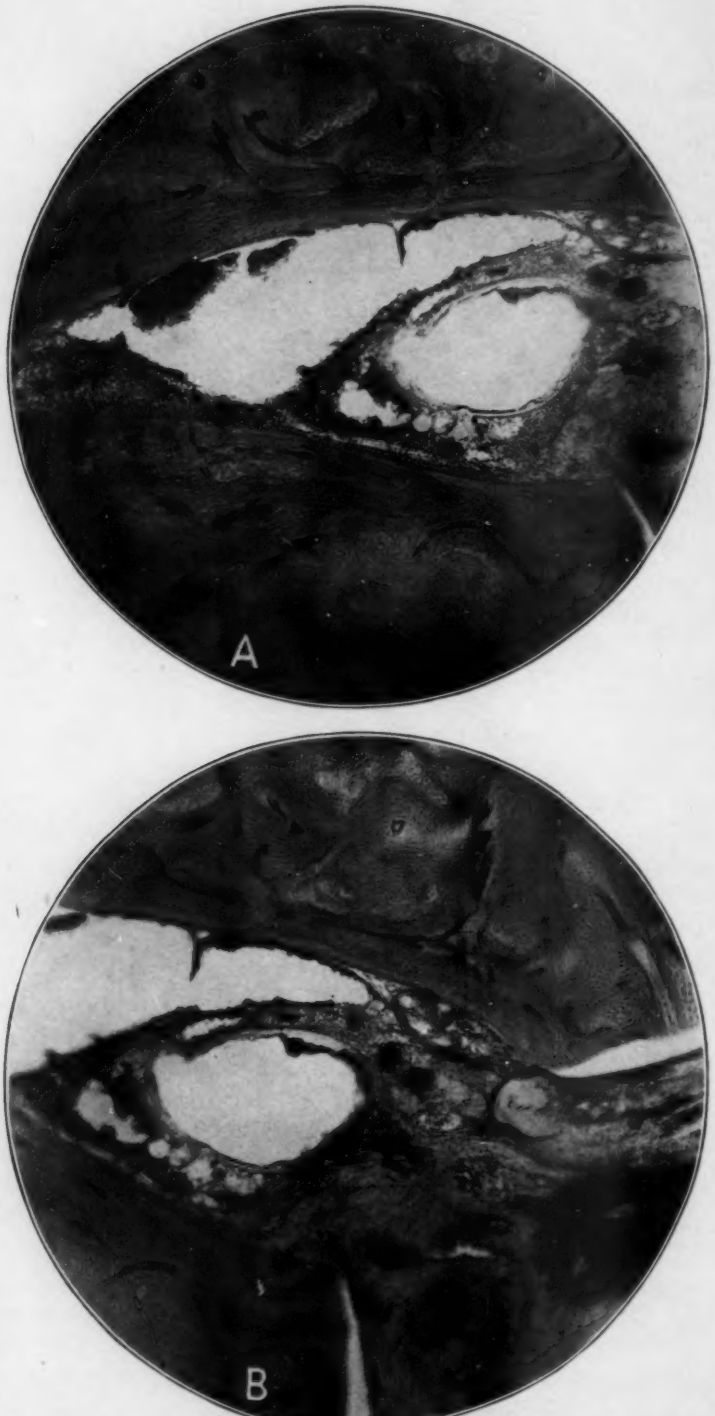

Fig. 13.—*A*, high power photomicrographs of sectioned temporal bone shows blood and fibrous connective tissue formation in the perilymphatic space of the fenestrated external semicircular canal. The endolymphatic labyrinth has become adherent to the tympanomeatal membrane that covers the fenestra. Fibrous connective tissue is seen between the endolymphatic labyrinth and the bony walls of the perilymph space.

B shows the endolymphatic labyrinth bound down by fibrous connective tissue within the perilymph space of the fenestrated external semicircular canal.

If this theory is correct, then a fenestra should be created, first, in that part of the vestibular labyrinth which has the largest circumference of perilymph space, and second, in a position anterior to the ampulla of the external semicircular canal instead of posterior to it. Thus the fenestra will be nearest to Shrapnell's membrane, which makes certain that Shrapnell's membrane always completely covers it. Such a fenestra should make a very unfavorable site for the organization and conversion of a small accumulation of blood within its perilymph space into fibrous connective tissue, and thus its closure by bony metaplasia of a connective tissue mass should be prevented.

In accordance with the aforementioned requirements, the dome of the vestibule was chosen as the most suitable and advantageous place for the creation of a new labyrinthine fenestra.

The measurements of the perilymphatic space in the region of the vestibule are, according to Gray,[3] as follows: 5 mm. in length from before backward; 5 mm. in depth from above downward, and 3 mm. across.

The perilymphatic space of the vestibule as compared in size with the perilymph space of the external semicircular canal, which is 0.8 mm. in circumference in the region posterior to the ampulla and twice that in the region of the ampulla, should enable the vestibule to act as a much better cisterna for the absorption and elimination of an infinitesimal amount of blood that has found its way into the perilymph space and thus prevent ultimate obliteration of a fenestra in the dome of the vestibule by the formation of fibrous connective tissue. Because the vestibule occupies a position much anterior to the prominence of the external semicircular canal, Shrapnell's membrane can easily be made to reach and cover the entire fenestra and thus discourage the conversion of a blood clot into connective tissue.

Because the newly created fenestra in the dome of the vestibule occupies a position immediately adjacent and superior to the functionally impeded fenestra ovalis and communicates directly with the scala vestibuli, I named it the fenestra nov-ovalis (the new oval window).

TECHNIC FOR THE CREATION OF FENESTRA NOV-OVALIS

As in the originally described fenestration technic, the temporal bone is exposed through the endaural antauricular approach. The mastoid antrum is opened, the bony mastoid cell structure is partially exenterated and the perilabyrinthine cell structure is removed, exposing to view the mastoid aspect of the basal labyrinthine portion of the petrous

3. Gray, H.: Anatomy of the Human Body, revised and re-edited by W. H. Lewis, ed. 23, Philadelphia, Lea & Febiger, 1936.

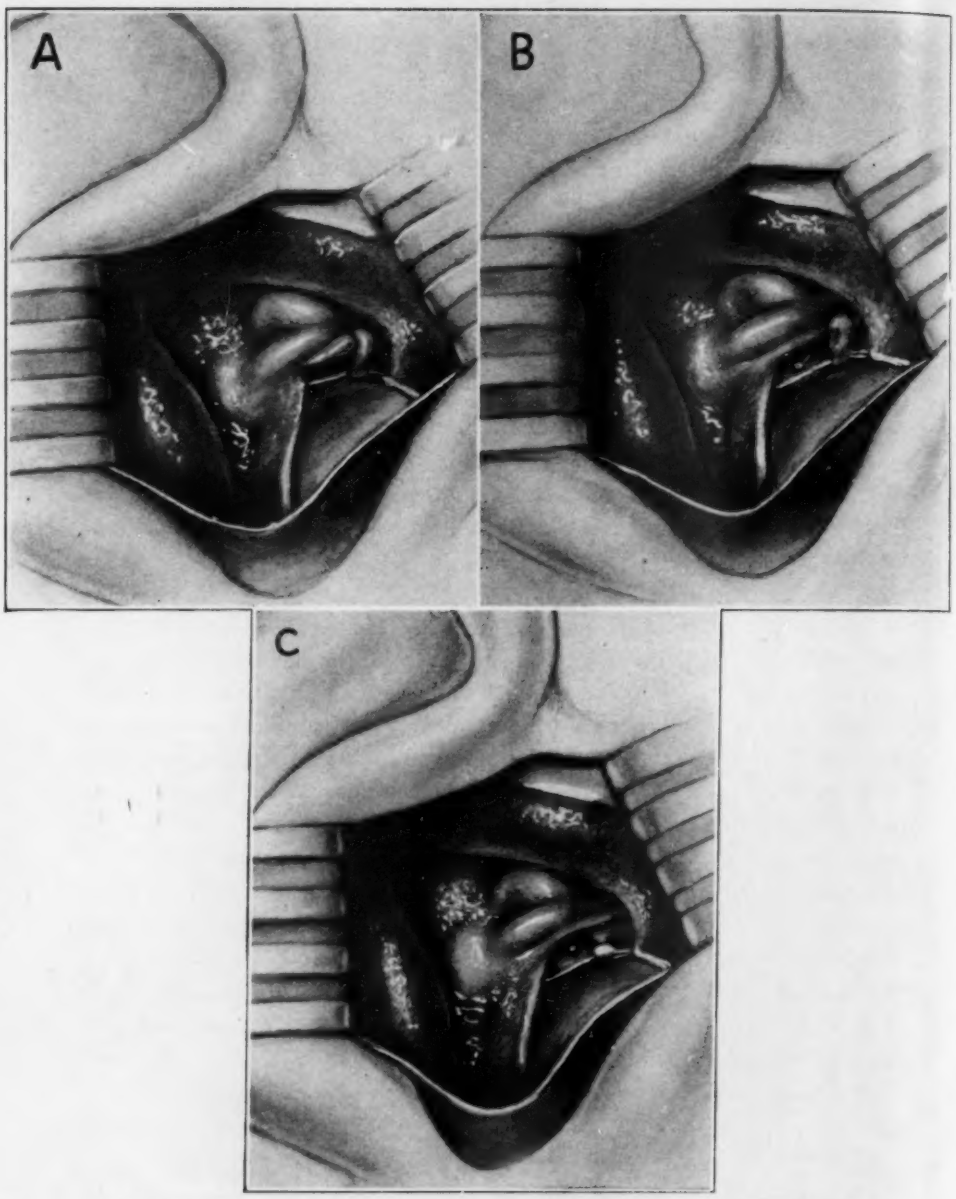

Fig. 14.—Technic. *A* demonstrates the exposure and sharp definition of the external, superior and posterior semicircular canals. The tympanomeatal cutaneous membrane has been created. The incudomalleolar joint, the anterior malleolar ligament and the chorda tympani nerve are exposed to view.

In *B* the incus and the pyramidal eminence have been removed. The fenestra ovalis, with the stapes in situ, and the tympanic course of the facial canal are exposed to view.

C illustrates the exposure of the dome of the vestibule. The head and neck of the malleus have been removed. The processus cochleariformis with the tendon of the tensor tympani muscle, the epitympanic course of the facial canal and the roof of the vestibule are exposed to view.

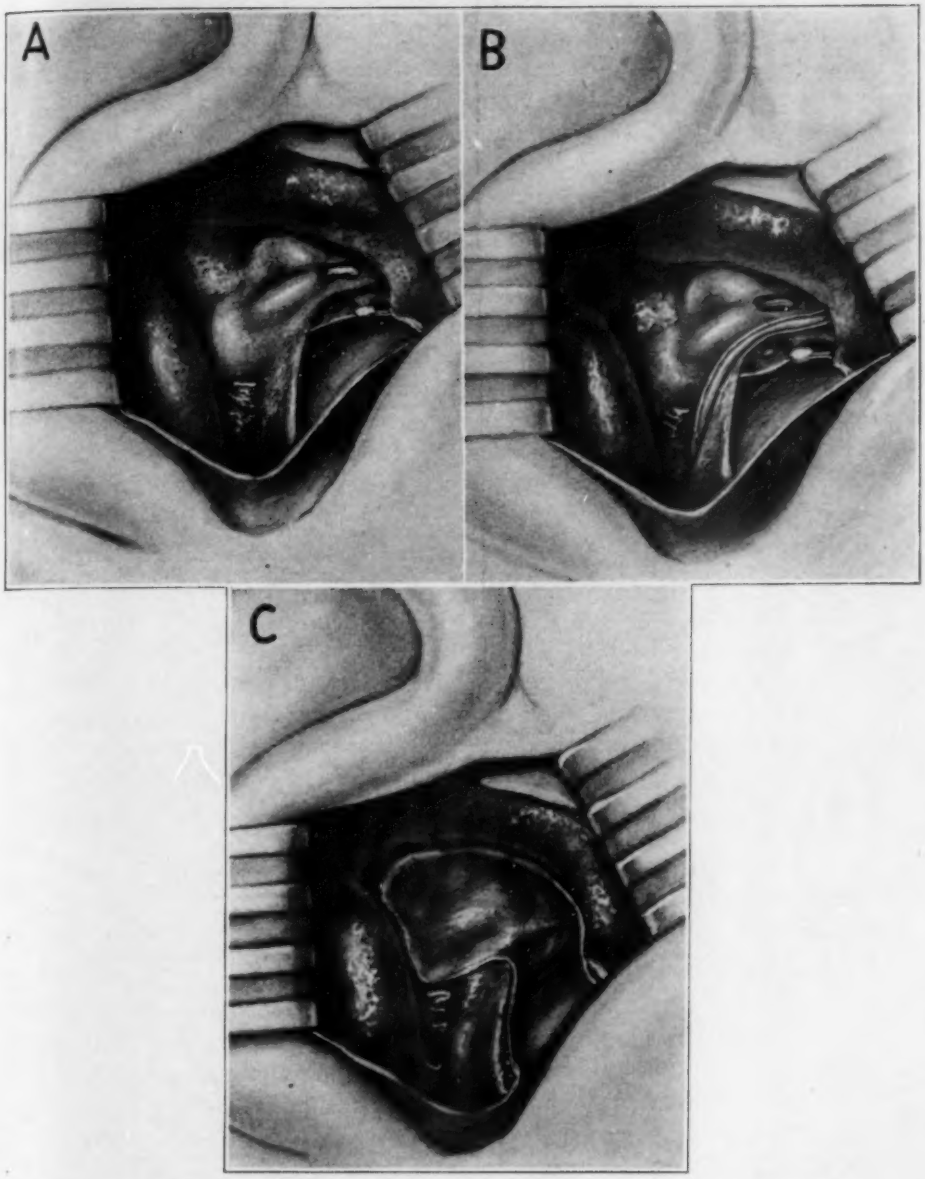

Fig. 15.—Technic. In *A* the new oval window, with the utricle exposed to view, is seen in the dome of the vestibule.

B illustrates the course of the facial nerve in relation to the fenestra nov-ovalis.

C shows the tympanomeatal membrane in position, with Shrapnell's membrane covering the entire fenestra nov-ovalis.

pyramid, with the prominence of the external semicircular canal sharply defined. The mastoid aspect of the posterior, superoposterior and superior bony walls of the external auditory canal is skeletonized by exenterating all the bony cellular mastoid structure lying adjacent to these walls, thus exposing the entire epitympanic recess, the incudomalleolar joint and the anterior malleolar ligament. The skeletonized posterior, superoposterior and superior bony walls of the external auditory canal are removed from the cutaneous membrane which lines these walls, including the corresponding portion of the sulcus tympanicus, lying at the inner margin of these bony walls, on either side of the notch of Rivinus. Care must be taken not to disturb the continuity of the outer dermal layer, which binds and holds together the cutaneous lining of the external auditory canal and the tympanic membrane. The pyramidal eminence is then removed, exposing to view the chorda tympani branch of the facial nerve and the long process of the incus, with the incudostapedial joint.

Exposure of the Vestibular Dome for Fenestration.—1. Removal of the Incus: The articular capsule of the incudomalleolar joint is divided, and the body of the incus is separated from the head of the malleus. The long process of the incus is then disconnected from the stapes, and the incus is removed and discarded. This exposes to view the ampullated ends of the external and the superior semicircular canal, the posterior half of the roof of the vestibule, the oval window, with the stapes in situ within the tympanic wall of the vestibule, and the tympanic transverse portion of the facial canal, lying external and superior to the oval window and separating it from the dome of the vestibule. Exposed to view is also the niche for the fenestra rotunda, as well as the posterior aspect of the cochlear promontory. In removing the incus, care must be exercised not to injure the chorda tympani nerve.

2. Removal of the Head and Neck of the Malleus: With a suitable instrument the head and neck of the malleus are amputated up to the attachment of the anterior malleolar ligament. This exposes to view the anterior half of the roof of the vestibule and the processus cochleariformis, with the tendon of the tensor tympani muscle attached to the manubrium mallei. External and superior to the processus cochleariformis, separating this structure from the anterior half of the roof of the vestibule, is seen the epitympanic anteriormost portion of the facial canal as far as the geniculate ganglion.

Creation of the Fenestra Nov-Ovalis.—1. Fenestration of the Bony Vestibular Dome and Exposure of the Perilymphatic Membranous Labyrinth: By means of a polishing burr, size 3, a fenestra measuring about 5 mm. in length and 2 mm. in width is created through the dome

of the bony capsule of the vestibule, down to the endosteal membrane lining the lumen. The fenestration is begun anterior to the ampullated ends of the superior and the external semicircular canal and is carried forward above and external to both the tympanic and the epitympanic course of the facial canal. With the aid of a Zeiss loop, the bony margins of the fenestral walls are shaved smoothly with dental spoon excavators until the fenestra assumes the desired shape and size. The inner cambium layer underneath the inner margins of the bony walls of the fenestra is shaved also. Finally, the bony walls are polished and burnished with a 24-carat gold burnishing burr. This completes the exposure of the perilymphatic membranous labyrinth.

Fenestration of the Perilymphatic Membranous Labyrinth and Exposure of the Endolymphatic Membranous Labyrinth.—With the aid of Zeiss magnifying spectacles, the endosteum which forms the outer protective wall of the membranous perilymphatic labyrinth is irrigated carefully by means of a rubber bulb syringe and washed with warm physiologic solution of sodium chloride, in order to remove any particles of bone dust which may have settled along the walls of the bony fenestra and on the outer surface of the endosteal membrane. The presenting surface of endosteum is then shredded carefully with a special needle, after which the shredded endosteum is floated and removed from the underlying perilymph by the aid of gentle irrigation with warm physiologic solution of sodium chloride. This results in a fenestra in the membranous perilymphatic labyrinth, exposing to view the membranous endolymphatic labyrinth. The part exposed to view is the utricle. The fenestra nov-ovalis vestibuli is now complete.

The risk of injury to the utricle within the perilymphatic space of the vestibule is much less than that of injury to the endolymphatic labyrinth within the perilymphatic space of the external semicircular canal, because the distance from the endosteum to the utricle in the vestibule is greater than that from the endosteum to the endolymphatic labyrinth in the external semicircular canal.

Covering of the Fenestra Nov-Ovalis with Shrapnell's Membrane.—One cone-shaped incision is made through the cutaneous membrane lining the superior bony wall of the external auditory canal. It is begun from the posterosuperior margin of the tympanic ring and is carried longitudinally outward along the superior bony wall of the canal as far as the anterior margin of the outer end of this bony wall and thence horizontally across the entire width of the roof of the bony canal 1 mm. internal to its outermost margin and up to its posterior end. Another cone-shaped incision is made through the cutaneous lining of the inferior bony wall of the external auditory canal. This is begun from the inner

posterior end of the inferior margin of the tympanic ring and is carried longitudinally outward along the bony floor of the canal, up to the anterior end of the outer margin of the bony floor and thence horizontally across the entire width of the outer margin of this floor, up to its posterior end.

Following these lines of incision, one elevates the cutaneous lining covering the bony roof and floor of the canal subperiosteally down to the tympanic ring, where only its outer dermal layer joins and becomes continuous with the outer dermal layer of the drum membrane. The drum membrane is then freed from the entire superior margin and the

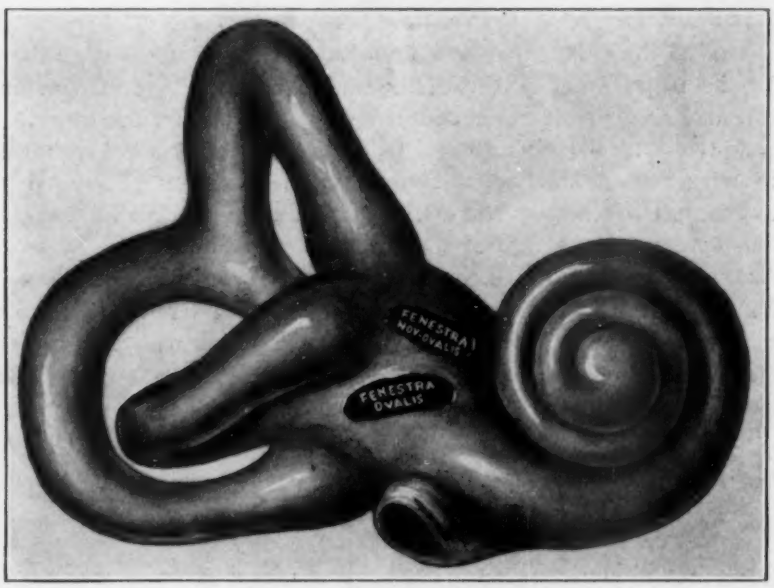

Fig. 16.—Technic. The illustration shows the anatomic relationship in position of the fenestra ovalis and the fenestra nov-ovalis in the vestibule.

posterior half of the inferior margin of the sulcus tympanicus and thus is converted into a movable and displaceable membrane. The cone-shaped meatal portion of the tympanomeatal membrane is now unfolded and is gently pulled backward into the mastoid wound. In being pulled backward, it carries with it the mobilized tympanic membrane. The tympanomeatal membrane is so placed that the tympanic portion thereof seals the entire tympanic air space, with Shrapnell's membrane easily covering the entire fenestra nov-ovalis, and the periosteum-lined meatal portion of the tympanomeatal membrane covers most of the floor of the mastoid wound.

Fig. 17.—Technic. The fenestra nov-ovalis with the utricle is exposed to view.

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If it is believed, as I pointed out, that it is essential or advantageous to cover a newly created labyrinthine fenestra with an epithelium-lined surface of a membrane facing the fenestra, it must be admitted that from this standpoint the new oval window, because of its very position, was a happy choice. The anatomic relationship of position between the fenestra nov-ovalis and Shrapnell's membrane makes the covering of the fenestra with this membrane possible in every case.

During the last eighteen months I have performed 235 fenestrations. In 75 of these I created the fenestra nov-ovalis. In every instance the new oval window has remained patent. In none of the cases do signs of impending closure of the fenestra exist to date. This is an unprecedented record for the patency of newly created labyrinthine fenestrae. Three patients submitted to an inspection of the fenestra nov-ovalis—one two months, one two months and nine days, and one five months and ten days, postoperatively. In none of these was the slightest sign of beginning bone regeneration or connective tissue formation observed. In all of these the new windows were found to have remained as widely patent as they were when created. I have therefore abandoned fenestration of the external semicircular canal and am now creating the fenestra nov-ovalis exclusively in all my cases. Figures 18 to 21 present audiograms showing that practical hearing can be restored and maintained by creating a new oval window in the vestibule proper.

FENESTRA NOV-OVALIS WITH OBTURATOR FRAME

For a number of years I have been unsuccessfully experimenting with all sorts of metal obturator frames, in an attempt to cover and protect the lateral bony walls of the fenestra and thus mechanically keep the newly created fenestra in the external semicircular canal permanently patent. The main obstacle in the way of success in this work was the unfortunately small circumference of the perilymph space within the external semicircular canal.

When I began to fenestrate the dome of the vestibule instead of the prominence of the external semicircular canal, the roomy perilymph space in that region offered the opportunity for the successful introduction, for the first time, of a metal obturator frame into the perilymph space and the maintenance of this frame in direct contact and apposition with the lateral bony walls of the fenestra nov-ovalis.

Description of the Obturator Frame.—The obturator frame, made of platinum and iridium (both inert metals) will fit a fenestra of any width up to 2.5 mm. The fenestra does not have to be made to fit the obturator, which has a movable wall and can be adjusted to the walls of the fenestra. It is nonirritating to the surrounding tissues. Though

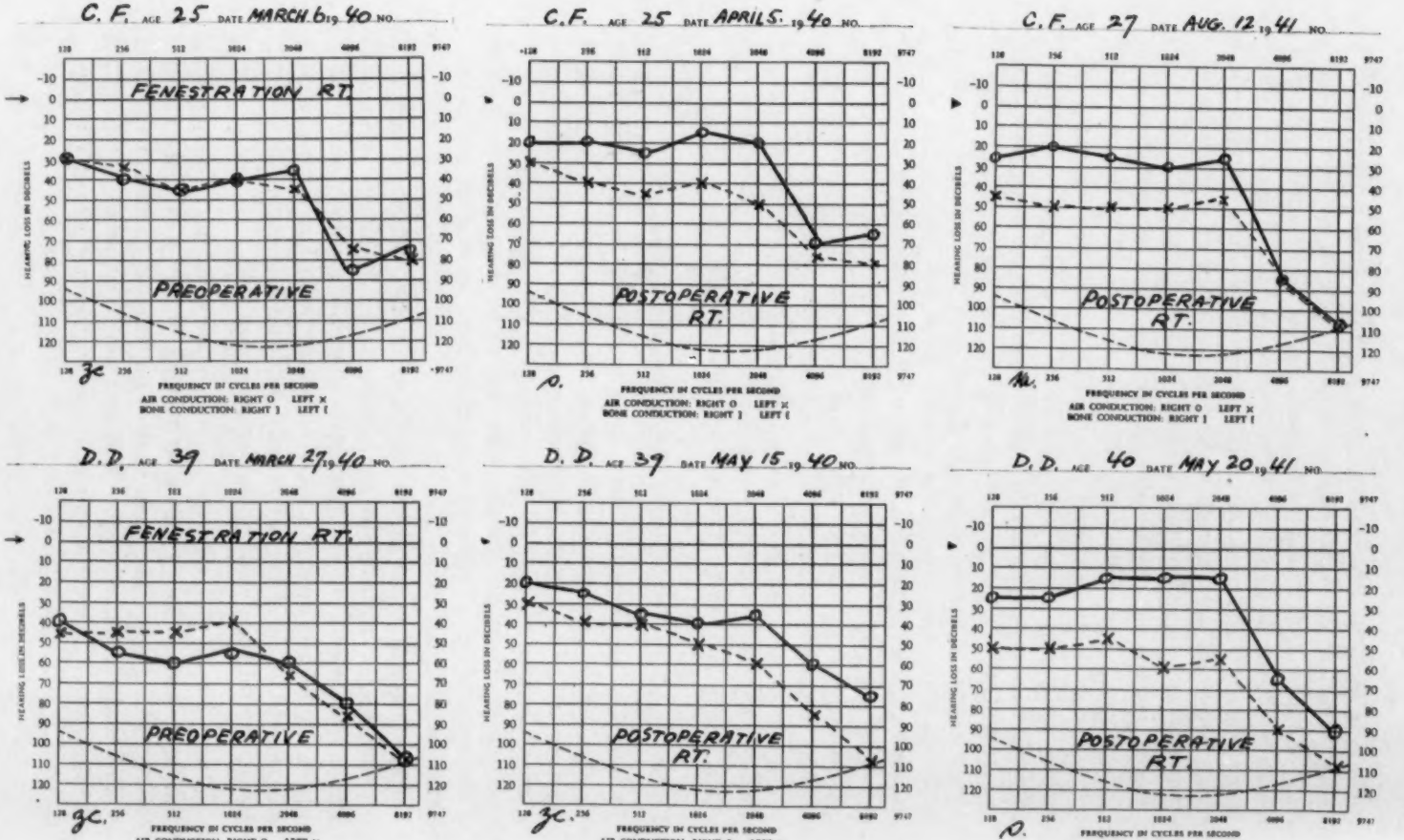
C. F. AGE 25 DATE MARCH 6 1940 NO.
FENESTRATION RT.
PREOPERATIVE
C. F. AGE 25 DATE APRIL 5. 1940 NO.
POSTOPERATIVE RT.
C. F. AGE 27 DATE AUG. 12 1941 NO.
POSTOPERATIVE RT.
D. D. AGE 39 DATE MARCH 27 1940 NO.
FENESTRATION RT.
PREOPERATIVE
D. D. AGE 39 DATE MAY 15 1940 NO.
POSTOPERATIVE RT.
D. D. AGE 40 DATE MAY 20 1941 NO.
POSTOPERATIVE RT.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 18.—Late hearing improvement resulting from the creation of the fenestra nov-ovalis in patients C. F. and D. D.

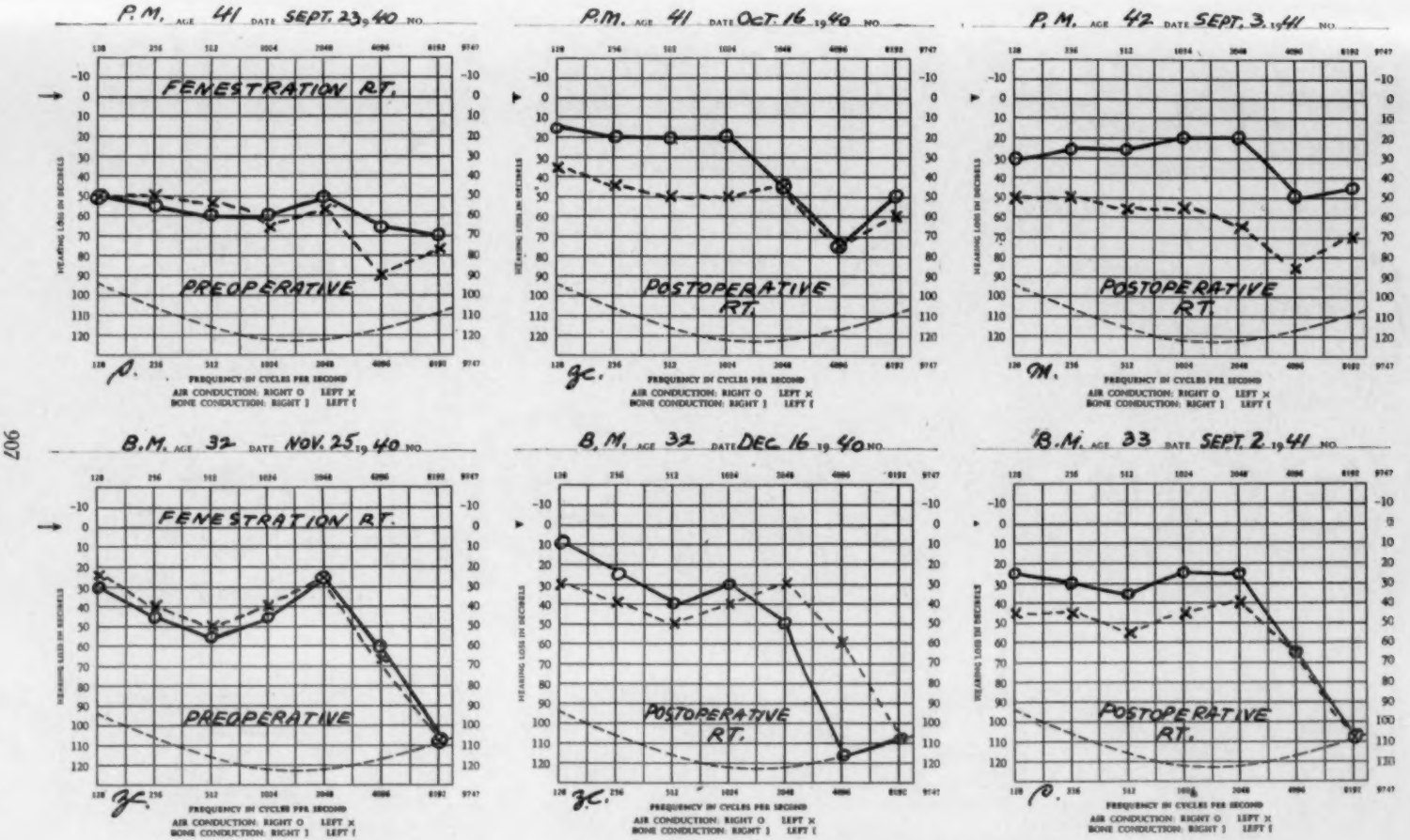

Fig. 19.—Late hearing improvement resulting from the creation of the fenestra nov-ovalis in patients P. M. and B. M.

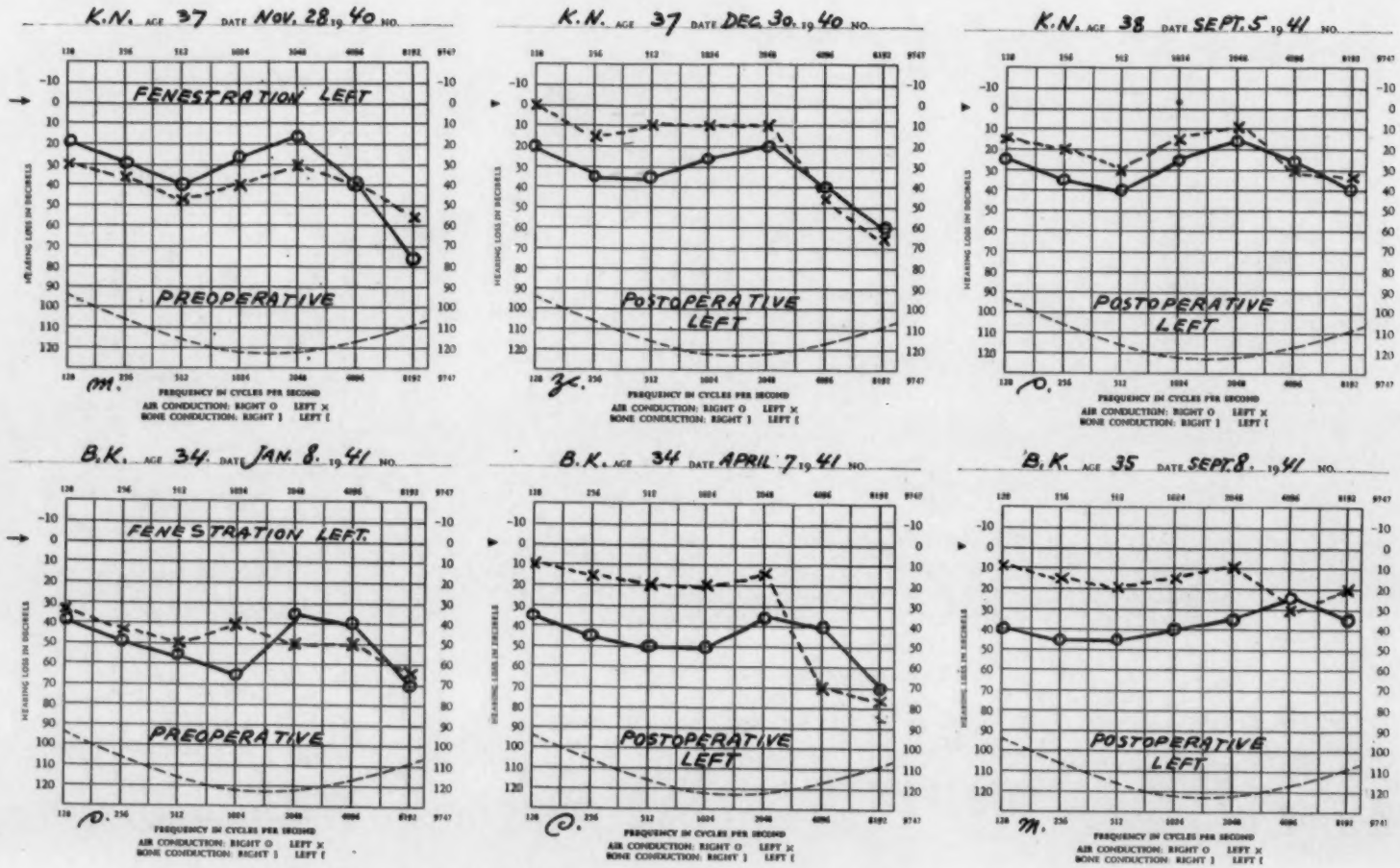
K.N. AGE 37 DATE NOV. 28 1940 NO.
FENESTRATION LEFT
PREOPERATIVE
K.N. AGE 37 DATE DEC. 30 1940 NO.
POSTOPERATIVE LEFT
K.N. AGE 38 DATE SEPT. 5 1941 NO.
POSTOPERATIVE LEFT
B.K. AGE 34 DATE JAN. 8 1941 NO.
FENESTRATION LEFT.
PREOPERATIVE
B.K. AGE 34 DATE APRIL 7 1941 NO.
POSTOPERATIVE LEFT
B.K. AGE 35 DATE SEPT. 8 1941 NO.
POSTOPERATIVE LEFT
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 20.—Late hearing improvement resulting from the creation of the fenestra nov-ovalis in patients K. N. and B. K.

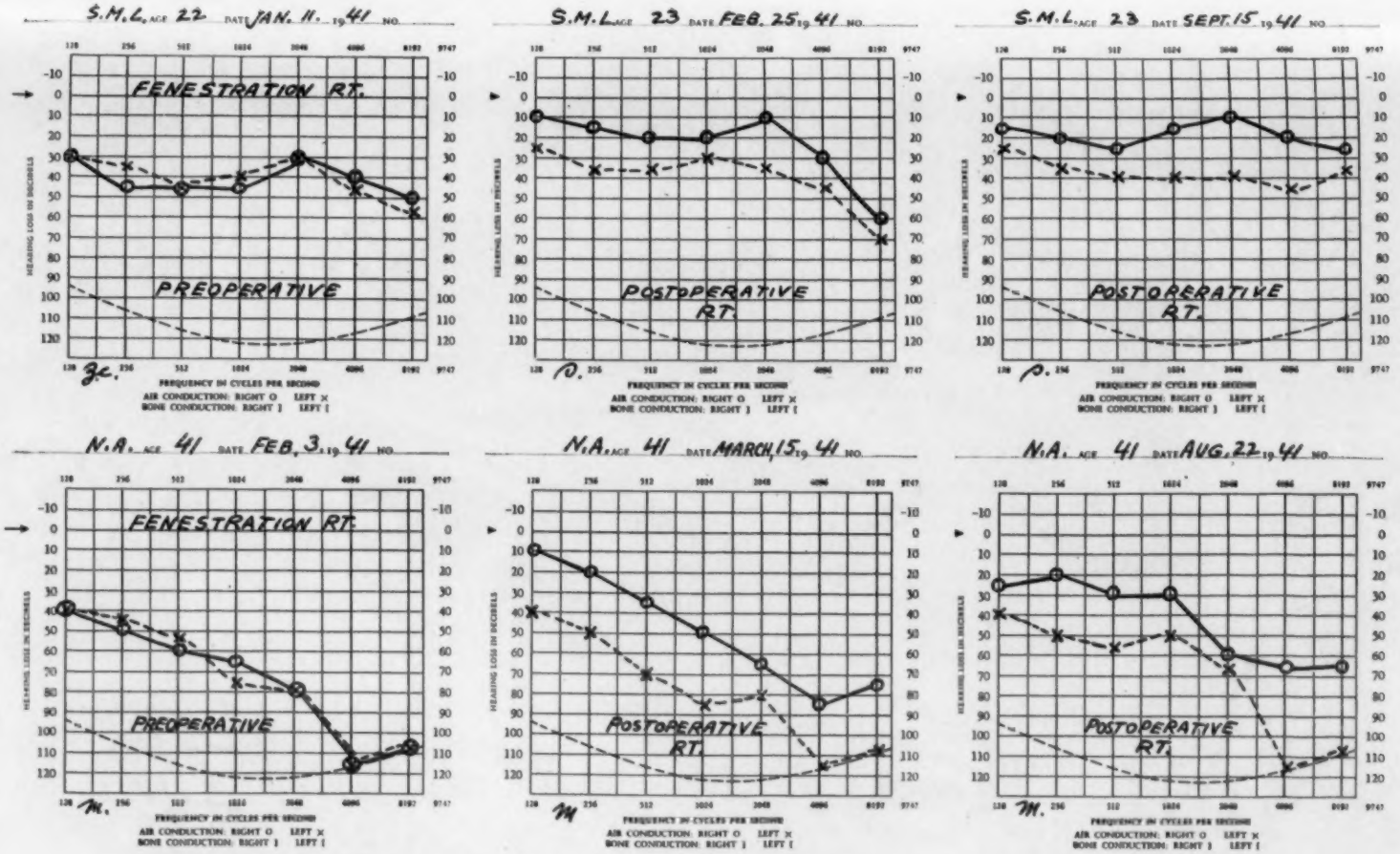
S.M.L. AGE 22 DATE JAN. 11. 1941 NO.
FENESTRATION RT.
PREOPERATIVE
S.M.L. AGE 23 DATE FEB. 25 1941 NO.
POSTOPERATIVE RT.
S.M.L. AGE 23 DATE SEPT. 15 1941 NO.
POSTOPERATIVE RT.
N.A. AGE 41 DATE FEB. 3. 1941 NO.
FENESTRATION RT.
PREOPERATIVE
N.A. AGE 41 DATE MARCH 15 1941 NO.
POSTOPERATIVE RT.
N.A. AGE 41 DATE AUG. 22 1941 NO.
POSTOPERATIVE RT.
HEARING LOSS IN DECIBELS
FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O LEFT X
BONE CONDUCTION: RIGHT] LEFT [

Fig. 21.—Late hearing improvement resulting from the creation of the fenestra nov-ovalis in patients S. M. L. and N. A.

it fits and hugs snugly the bony walls of the fenestra, it does not exert any pressure on these walls.

The anterior wall of the obturator is made stationary, while the posterior wall is movable. The obturator is inserted into the fenestra

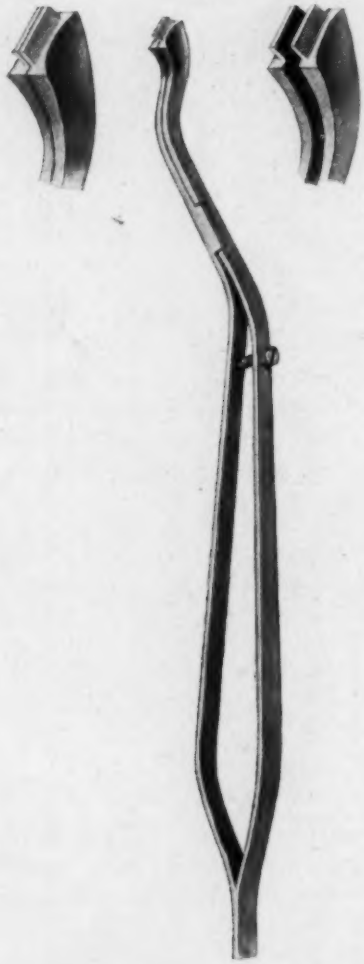

Fig. 23.—Technic. An instrument specially designed for the introduction of the obturator frame.

with its lateral walls, which are 0.75 mm. deep, but slightly separated, and is then opened and spread in situ with a special instrument until the metal walls contact the lateral bony walls and cannot be spread any farther apart. Then, with an automatic mallet, the posterior flat surface of the frame is struck. This locks the movable plate in position

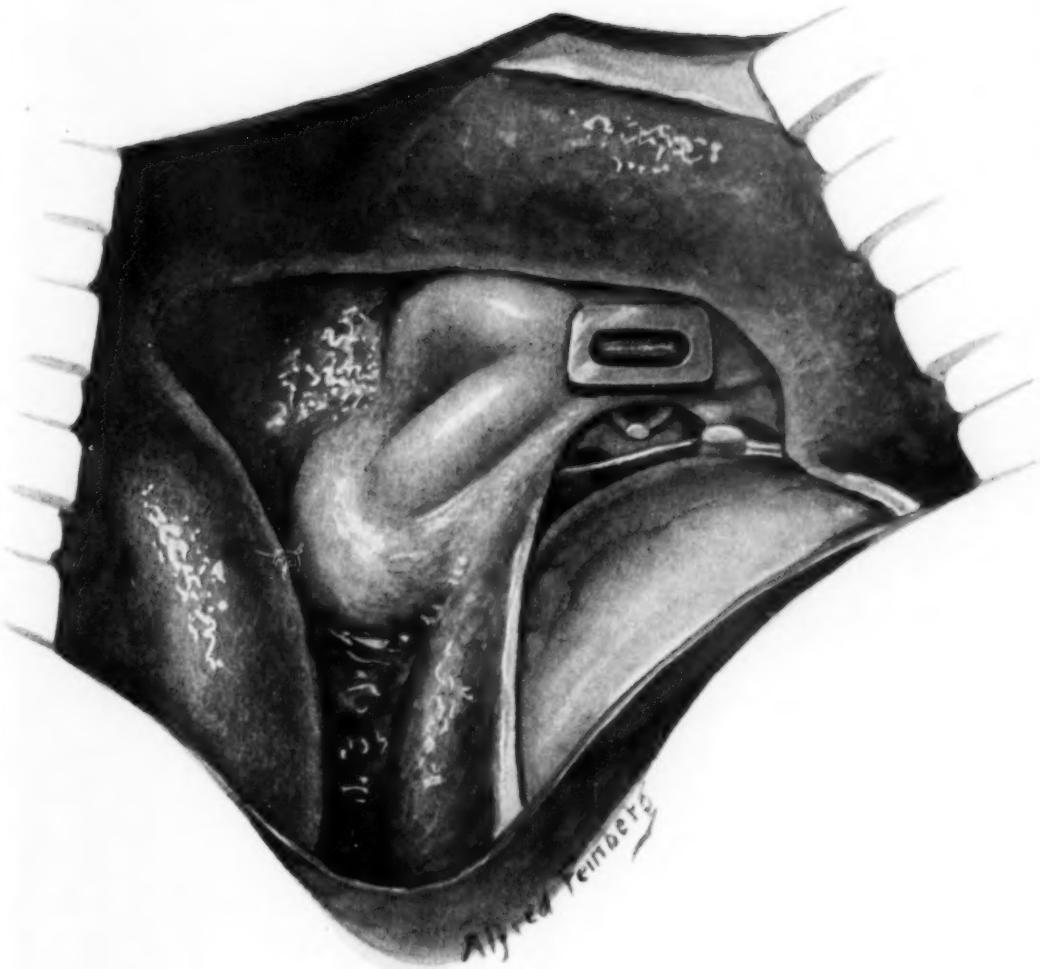

Fig. 22.—Technic. The fenestra nov-ovalis with an obturator frame in situ.

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so that it can no longer slide back to its original closed position. The only requirement for the placement of the obturator is certainty that the dome of the vestibule retains a flat surface after the fenestra is created and that the lateral bony walls are evenly shaped to a straight margin. The obturator is inserted before the endosteum is removed. The endosteum is then removed through the obturator frame. The fenestra nov-ovalis with the obturator frame in situ is covered and protected with the epithelium-lined inner surface of Shrapnell's membrane, and the periosteum-lined inner surface of the meatal portion of the tympanomeatal membrane is employed to cover the floor of the antrum and mastoid wound, to which it becomes attached.

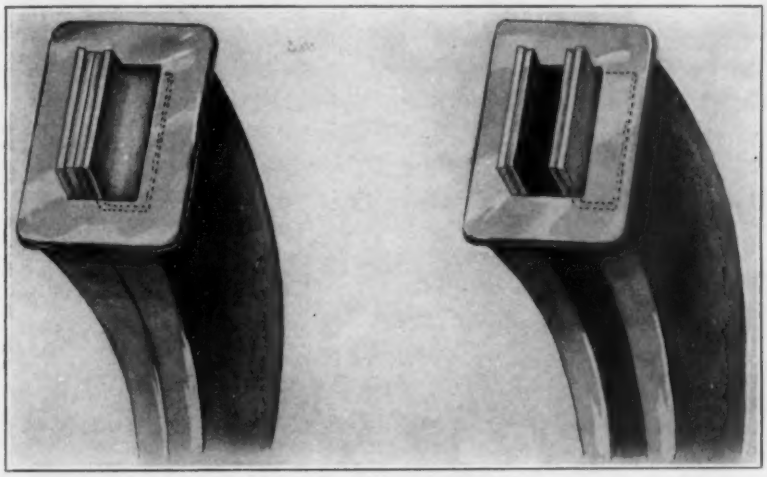

Fig. 24.—Technic. Note the closed position of the walls of the obturator frame when the frame is introduced into the fenestra nov-ovalis and the spreading of the lateral walls of the frame to meet the bony walls of the fenestra.

In a separate series of cases, the use of the obturator frame with the fenestra nov-ovalis is now being tested as one more way of keeping the fenestra patent. The tests will be watched for another year, at the end of which time I shall report whether any advantage results from the use of the obturator frame in the fenestra nov-ovalis. Should these cases prove as successful as those in which the obturator frame was not used, the way may be opened for a further simplification of technic.

SUMMARY AND CONCLUSIONS

The creation of the fenestra nov-ovalis is a step forward in the evolution of fistulization of the labyrinth. After careful investigation and study of the results obtained in 300 fenestrations of the external

semicircular canal, the new oval window was conceived and designed to overcome an important obstacle to still greater success with this type of operation.

I have created the fenestra nov-ovalis in 75 patients during the last eighteen months. In not one of these patients has the newly created vestibular fenestra closed or shown the slightest tendency to closure. This promising new consecutive "high" for continued patency of newly created labyrinthine fenestrae caused me to abandon fenestration of the external semicircular canal, and I am now fenestrating the vestibule proper in all my cases.

The comparatively large dimensions of the perilymphatic space in the region of the fenestra nov-ovalis offer an opportunity for inserting and permanently maintaining in direct contact with the lateral bony walls of the fenestra an inert metal obturator frame, in order to mechanically prevent the fenestra from closing.

The observations reported indicate that the fenestra nov-ovalis is anatomically the best placed, histologically the best constructed and physiologically the best functioning hearing window conceived and employed to replace a functionally impeded fenestra ovalis. Like the fenestra ovalis, the fenestra nov-ovalis communicates directly with the scala vestibuli. Like the fenestra rotunda, it is covered and protected by the thinnest possible membrane, both the inner and the outer surface of which are epithelium lined.

ROENTGEN THERAPY FOR BRONCHIECTASIS

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Numerous contributions on the treatment of bronchiectasis have appeared in the literature. However, in spite of the many excellent procedures advocated, the therapy is still far from satisfactory except for the small group of patients who can be treated by surgical measures. Recently Berck [1] recorded a small series of cases in which roentgen ray therapy was employed satisfactorily in the treatment of chronic bronchiectasis. Later, he and Harris [2] extended their series of cases to 65. They secured lasting benefit for a large percentage of their patients. Prompted by these excellent results, we undertook the treatment of 38 patients with chronic bronchiectasis by roentgen rays and herein report our experiences and results.

Roentgen therapy has been advocated for a great variety of acute and chronic inflammatory conditions. In many areas of the body, it has proved its worth, but in the lungs the results have been variable. Berck and Harris [2a] reasoned that if salivary glands exposed to roentgen rays show a diminution of secretion a comparable reaction may be produced in the bronchial mucosa of bronchiectatic areas, with a decrease in expectoration. They commented, however, that there is little evidence to support this analogy, so that in all probability the results obtained are due to the effect of roentgen rays on a chronic inflammatory process. Frenckner [3] reported experimental investigations on the effect of various dosages of roentgen rays on the ciliated epithelium of the upper respira-

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1. Berck, M.: Radiotherapy for Bronchorrhea in Bronchiectasis, J. Mt. Sinai Hosp. **1**:98-100 (July-Aug.) 1934.

2. Berck, M., and Harris, W.: (*a*) Roentgen Therapy for Bronchiectasis, J. A. M. A. **108**:517-522 (Feb. 13) 1937; (*b*) Further Experience with Roentgen Therapy for Bronchiectasis, Radiology **32**:693-698 (June) 1939.

3. Frenckner, P.: Effect of Roentgen and Radium Radiation upon Action of Cilia Within Respiratory Tract, Acta oto-laryng. **37**:297-309, 1939.

tory tract. He noted a definite weakening or arrest of movement of the cilia when these were exposed to relatively small doses of radiation. Probably this effect could be disregarded with respect to bronchiectasis, as undoubtedly the cilia in bronchiectatic areas are partially or completely destroyed. However, there is a possibility that such an effect produced in unaffected portions of a bronchus would tend to cause stagnation of secretions, which are normally removed by ciliary action.

THE PATIENTS

All the patients selected for treatment had bronchiectasis of the chronic variety and had been observed for months or years, during which time their condition had remained practically stationary. All had had treatment of the foci of infection, bronchoscopic and postural drainage, diets high in vitamins and calories, climatotherapy and other forms of treatment. Autogenous vaccines had been employed, unsuccessfully, in a few cases. No patients whose symptoms were recent or acute were included in this group. In all cases bronchoscopic and bronchographic examinations were made and aspirated secretions cultured prior to treatment in order to establish the diagnosis of bronchiectasis unequivocally.

In order to establish a comparison with previously reported series of cases in which the same type of therapy was used, we adopted the classification suggested by Archibald.[4] In this classification, patients with chronic secreting bronchiectasis are divided into three groups. To these three groups we have added a fourth.

Group 1.—The patients in this group have clinical symptoms suggestive only of an aggravated form of chronic bronchitis, with catarrhal infection superadded later. Bronchograms reveal only the cylindric form of dilatation, without evidence of bronchiectatic abscesses, and the pulmonary roentgenograms show the parenchyma of the lung to be free of shadows. A patient of this type suffers from cough and produces considerable and variable amounts of sputum, which may be mucoid or mucopurulent. Episodes of fever are infrequent, as are pneumonitis and hemoptysis. There is no physical debility, and rarely does a patient require hospitalization, the only disability being the cough and expectoration.

Group 2.—This group is composed of patients who clinically occupy an intermediate position between groups 1 and 3. Cough is a distressing symptom, and there is expectoration of a moderate amount of sputum, which occasionally is foul smelling. Remissions are rare. Fever and

4. Archibald, E.: A Consideration of the Dangers of Lobectomy, J. Thoracic Surg. **4**:335-351 (April) 1935.

pneumonitis occur occasionally. Although the patients are harassed by cough and expectoration, they are still ambulatory and are not incapacitated for work. Bronchograms are likely to show cylindric and saccular dilatations, with diffuse thickening of the lung parenchyma but no clearly defined abscesses.

Group 3.—These patients suffer from chronic sepsis and appear to be chronically ill. They are totally incapacitated for work; occasional or frequent episodes of fever and pneumonitis are the rule; cough is disabling; sputum is abundant and often fetid; hemoptysis is not unusual, and clubbing of the fingers and nails, if present, is marked. Bronchograms reveal saccular, fusiform and cylindric dilatations, frequently with large and small pulmonary abscesses. There is marked parenchymal involvement, which usually affects the entire lobe or lobes.

Group 4.—The patients in this added group are those in whom a pulmonary abscess or abscesses preceded the appearance of the bronchiectasis.

THE THERAPY

The majority of the patients were ambulatory during the period of study, and no other treatment was used in conjunction with the roentgen ray therapy. The physical factors were 200 kilovolts, a distance of 50 cm., and filtration through 0.5 mm. of copper. The size of the field was 10 by 10 cm. for children and 10 by 15 cm. for adults. The average total dose for each field varied from 1,200 to 1,700 roentgens (r), the average being 1,500 to 1,600 r. Treatment was given through anterior, lateral and posterior fields. The average daily dose varied from 100 to 200 r, given through two fields. The treatments usually were completed in three weeks. In the cases in which there was bilateral involvement, only one side was treated at a time; after a period of several months, the other side was treated.

RESULTS

Except for a few gastrointestinal upsets, which could be attributed to "irradiation sickness," and an occasional slight secondary anemia, no deleterious reactions were encountered. During the course of the treatment and for several months after its completion, there was usually an increase in the cough and expectoration. After this there was gradual cessation of symptoms in patients who responded to this form of therapy. Several patients who did not obtain improvement noticed that the sputum was less viscid and easier to cough up. Two patients who experienced temporary improvement but subsequently returned to their former condition noticed this decrease in the viscosity of the sputum.

Group 1.—Nine patients were included in this group. Of these, 2 (22 per cent) showed marked improvement, 2 (22 per cent) were

moderately improved, while 1 patient (11 per cent) showed mild improvement. Four patients (45 per cent) were unimproved. Thus 55 per cent of this group received some benefit. Two patients showed some improvement for about a year but recently have had an increase in cough and sputum. There were no deaths in this series and no post-irradiation atelectasis or pneumonitis.

Group 2.—Eighteen patients were included in this group. Of these, 3 (17 per cent) showed marked improvement. It is interesting to note that 1 of these had bilateral involvement, with bronchographic demon-

TABLE 1.—*Data on Group 1 (Nine Cases)*

Result of Treatment	Patients	Percentage
Marked improvement	2	22
Moderate improvement	2	22
Mild improvement	1	11
No improvement	4	45

TABLE 2.—*Data on Group 2 (Eighteen Cases)*

Result of Treatment	Patients	Percentage
Marked improvement	3	17
Moderate improvement	4	22
Mild improvement	2	11
No improvement	9	50

TABLE 3.—*Data on Group 3 (Nine Cases)*

Result of Treatment	Patients	Percentage
Marked improvement	0	0
Moderate improvement	2	22
Mild improvement	1	11
No improvement	6	67
Deaths	5	55

stration of mild cylindric bronchiectasis on the right side and moderate cylindric and saccular bronchiectasis on the left side. The less involved side was treated, while the more involved side was not. This patient, however, experienced marked improvement. Four patients (22 per cent) showed moderate improvement, 2 (11 per cent) obtained mild improvement, while 9 (50 per cent) were unimproved. Therefore, 50 per cent of this group showed varying degrees of benefit from roentgen therapy. There were no deaths in this group and no post-irradiation pneumonitis or atelectasis.

Group 3.—Nine patients were classified in this group. Of these, none showed marked improvement, 2 (22 per cent) showed moderate improvement and 1 (11 per cent) showed mild improvement, while 6 (67 per cent) showed no improvement.

The 2 patients showing moderate improvement were children, and theirs were the only cases in which we had the opportunity to use roentgen ray therapy for bronchiectasis in childhood. The improvement noted in these 2 children indicates that there is a possibility that roentgen therapy may be of value in the treatment of bronchiectasis in childhood.

There were 5 deaths in this group, which was the only one showing any mortality. Of the 5 patients who died, only 1 had obtained any improvement, while the remainder were unimproved. Thus, in this group, only 33 per cent received any benefit. In 1 instance, partial atelectasis developed shortly after the last treatment; this was followed by overwhelming pneumonitis. Another patient died of pneumonia a few months after the completion of the course of therapy. A postmortem examination was performed on 2 of these 5 patients. One of them had bronchiectasis of the lower lobes of both lungs and had received therapy to one side. At necropsy both lungs showed multiple abscesses

TABLE 4.—*Data on Group 4 (Two Cases)*

Result of Treatment	Patients	Percentage
Marked improvement	0	0
Moderate improvement	0	0
Mild improvement	1	50
No improvement	1	50

and large sacculations. The other patient died shortly after the completion of the course of therapy, although one side had been treated a year and a half before. Postmortem examination again showed the lungs to be riddled with cavities. No pulmonary fibrosis that could be attributed to roentgen therapy was found in either of these patients, and there was no evidence that roentgen therapy had decreased the secretory power of the bronchial mucosa in the bronchiectatic areas.

Group 4.—Two patients were classified as having bronchiectasis secondary to pulmonary abscess. One of these was definitely worse after treatment and secured relief only after permanent interruption of the phrenic nerve. The other patient received mild benefit from roentgen therapy.

COMMENT

The improvement obtained in our series of cases of bronchiectasis is certainly not striking, although a small percentage of the patients secured benefit for at least the period of observation. The greatest improvement was seen in patients with minimal and moderate involvement. Berck and Harris [2b] obtained improvement in 80 per cent of the patients whom they classified in group 1. Of this 80 per cent, 60 per

cent were greatly improved. Only 22 per cent of our patients could be said to be greatly improved, although 55 per cent received some benefit.

Berck and Harris classified their patients somewhat differently and did not include patients in whom the disease was in a moderately advanced stage (group 2); so no comparison can be made with such a group. However, 50 per cent of the patients in our group 2 showed some improvement, but only 17 per cent showed marked improvement. Among the patients with advanced bronchiectasis, we noted benefit in only 33 per cent; none of these patients obtained marked improvement. In contrast to this, Berck and Harris found that 62 per cent of their patients with advanced bronchiectasis were improved and that of this 62 per cent, 45 per cent were greatly improved. In the group in which bronchiectasis was secondary to pulmonary abscess, we had only 2 patients, so no conclusions can be drawn regarding the effectiveness of roentgen therapy. The series of cases here reported is small, and it may be that with further experience our results will be different.

Few ill effects were encountered that can be attributed to the irradiation. A few patients had some gastrointestinal upsets, which subsided during the period of treatment or shortly thereafter. Pneumonitis was encountered in a few of the patients of the group in which bronchiectasis was far advanced. It was invariably fatal. In several cases bronchograms were made at varying intervals after treatment, and no changes were noted in the size and extent of the bronchial dilatations. Roentgenograms of the chest were taken in all cases, and there was no evidence of pleural thickening, pulmonary fibrosis or mediastinal retraction.

From our experience and results we must conclude that roentgen irradiation is only a moderately satisfactory treatment of bronchiectasis. We have attempted to analyze our good results on the basis of age, bacteriologic findings, duration of symptoms and similar considerations but have failed to arrive at any definite conclusions on which criteria might be established for the prediction of the results of roentgen therapy in any given case. However, from the results obtained in 2 cases of childhood bronchiectasis, it seems that there is a possibility that roentgen therapy may be of value in the treatment of bronchiectasis in children.

Roentgen therapy may be a valuable adjunct in the treatment of patients whose pulmonary lesions are not amenable to surgical treatment and whose symptoms have not been relieved by other forms of treatment, such as bronchoscopic drainage, postural drainage and vitamin and diet therapy. There is also a small group of patients whose physical condition and age are such that any active treatment is contraindicated. In addition, some patients cannot adhere to a prolonged regimen of therapy, and therefore roentgen radiation offers the only available means of treatment.

SUMMARY AND CONCLUSION

Roentgen treatment of patients with chronic bronchiectasis has resulted in some symptomatic improvement in about 50 per cent of those in whom the disease was mild or moderately advanced and in a small percentage of those in whom the disease was far advanced.

Roentgen therapy may be a valuable adjunct in the treatment of patients who have had little improvement from treatment of the foci of infection by bronchoscopic drainage and other forms of therapy and who are not amenable to surgical treatment. It may be of value also in the treatment of elderly patients with cardiac disease, patients for whom bronchoscopic treatment is contraindicated because of age and other conditions, patients who cannot follow a prolonged regimen of treatment and possibly young children.

OTORHINOGENIC HYDROCEPHALUS

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Since Symonds' publications in 1927 [1] and 1931,[2] the name "otitic hydrocephalus" has been accepted for a group of cases which present the following clinical syndrome: After an infectious disease of the ear, mastoid process or petrous bone, the patient complains of attacks of severe headache. In the interval between headaches, he looks and feels well. Examination of the cerebrospinal fluid reveals a constant elevation of pressure, often above 300 mm. of water. There are no cells or excess of proteins in the fluid. Papilledema is always present, and the swelling is usually measurable. There are often signs such as paralysis of the sixth nerve on the side of the lesion, unilateral or bilateral convulsive seizures, the Babinski sign on one or both sides and, in cases in which the posterior fossa is involved, nystagmus, vertigo, adiadokokinesis and deviation of the protruding tongue. The patients are almost always children or young adults.

In accordance with the supposed pathologic changes and causation, different authors have described cases of this condition under various names. Oppenheim,[3] Voss,[4] Borries [5] and Yerger [6] stated the opinion that the syndrome was caused by nonsuppurative encephalitis. Passot [7] called the condition aseptic meningitis; Mygind [8] called it a benign form of otogenic meningitis, and Adson [9] gave it the name "pseudobrain abscess." The latter name is worthy of remembrance because, while

1. Symonds, C. P.: Some Points in the Diagnosis and Localization of Brain Abscess, J. Laryng. & Otol. **42**:440-448 (July) 1927.

2. Symonds, C. P.: Otitic Hydrocephalus, Brain **54**:55-71 (April) 1931.

3. Oppenheim, H.: Zur Encephalitis acuta non-purulenta, Berl. klin. Wchnschr. **37**:201-204 (March 5) 1900.

4. Voss, F.: Drei Fälle von Encephalitis in Anschluss an Otitis media, Ztschr. f. Ohrenh. **41**:223-233, 1902.

5. Borries, G. V. T.: Die otogene Enzephalitis, Ztschr. f. d. ges. Neurol. u. Psychiat. **70**:93-101, 1921.

6. Yerger, C. F.: Acute Toxic Meningo-Encephalitis of Otorhinogenic Origin, Arch. Otolaryng. **1**:198-208 (Feb.) 1925.

7. Passot, R.: Méningites et états méningés aseptiques d'origine otique, Thesis, Paris, no. 247, Paris, G. Steinheil, 1913.

8. Mygind, H.: Benign Forms of Otogenic Meningitis, J. Laryng. & Otol. **37**: 597-612 (Dec.) 1922.

9. Adson, A. W.: Pseudobrain Abscess, S. Clin. North America **4**:503-512 (April) 1924.

indicating neither the pathologic changes nor the cause, it emphasizes the fact that the greatest difficulty in this type of case lies in making the differential diagnosis between brain abscess and otitic hydrocephalus.

The name "otitic hydrocephalus" certainly does not cover all the cases belonging to this group. Although in most of the cases the syndrome originates from complications of disease of the ear, in many of them it follows infection of the paranasal sinuses. Yerger,[6] Carmack [10] and Yaskin [11] reported cases in which the syndrome described followed infection of the paranasal sinuses. In a case to be described herein the syndrome was caused by an infection of the frontal sinuses. It appears, therefore, that the use of the term "otitic hydrocephalus" to describe this condition is perhaps at fault and that "otorhinogenic hydrocephalus" would be a better name for the entity.

Symptoms similar to those described in an earlier paragraph are found in other diseases, such as tumor, multiple embolism, thrombosis of the cerebellar artery, syphilis and subdural hematoma, but under "otorhinogenic hydrocephalus" I describe only those cases in which this syndrome originated from infection of the ear or nose.

The chief and most persistent sign is the great increase in pressure of the cerebrospinal fluid without any striking change in the chemistry or the cellular content of the fluid.

Bateman [12] stated that the cerebrospinal fluid is formed from the blood. The choroid plexuses, with their secretory cells, have in a physiologic sense the same functional activity as have the secretory cells of the parotid, lacrimal or pancreatic glands. It is generally believed and is in part substantiated by evidence obtained experimentally that the bulk of the fluid comes from the choroid plexuses of the lateral, third and fourth ventricles.

The fluid has a slow but constant circulation. It passes out of the lateral ventricles through the interventricular foramen, into the third ventricle and from there into the fourth ventricle by way of the aqueduct of Sylvius. Its further passage is through the two lateral foramens of Luschka and the median foramen of Magendie into the cisterna magna. Thence, the fluid spreads to the ventral aspect of the pons and to its lateral prolongations, which occupy the cerebellopontile angles and are adjacent to the petrous pyramid, to the cisterna interpeduncularis, which occupies the space between the cerebral peduncles anterior to the pons, and to the chiasmic cistern, in the region of the optic chiasm. The fluid

10. Carmack, J. W.: The Relation of Increased Intracranial Pressure to Disease in the Pneumonic Spaces, Ann. Otol., Rhin. & Laryng. **42**:364-371 (June) 1933.

11. Yaskin, J. C.: Neurologic Complications of Infections of the Temporal Bone and Paranasal Sinuses, Arch. Otolaryng. **30**:360-389 (Sept.) 1939.

12. Bateman, J. F.: Meningitis with Special Reference to the Role of the Pacchonian Bodies, Ohio State M. J. **25**:970-976 (Dec.) 1929.

passes through the entire cisternal system, then upward through the tentorial notch and over the cerebral cortex, where it reaches its final destination, the pacchionian bodies, through which it passes into the blood stream.

The pacchionian bodies are tuftlike spongy masses of arachnoid tissue that do not contain blood vessels, lymphatics or nerves and consist of a dense interlacement of flattened bundles of fine fibrous tissue interspersed with elastic fibers and platelike cells.

These small tufts of arachnoid tissue are covered externally with endothelium. They push before them the greatly attenuated dura and, overlaid by the latter and the endothelial lining of the blood space, they project into the superior longitudinal sinus or its lateral diverticula. The pacchionian bodies occur in patches and are situated for the most part on each side of and close to the longitudinal sinus.

Any inflammatory process within the meninges may be considered obstructive, because, according to Bateman, the pacchionian bodies bear the brunt of any subarachnoid inflammatory process. In his excellent symposium, Williams [13] stated that it is evident that hydrocephalus may accompany any inflammatory condition in which toxins or bacteria reach the arachnoid in sufficient concentration to produce inflammatory change. The preponderance of cases of acute hydrocephalus in association with otitic disease is in all probability attributable to the frequency with which inflammation of the dura is associated with infection of the ear.

The material secured in cases of otitic hydrocephalus has been meager and has shown little pathologic change. Encephalitic scarring was noted by Oppenheim,[8] but in most cases the only finding was a moderate degree of inflammatory change in the arachnoid, without any visible sign of encephalitis. Williams [13] stated:

> Bateman's evidence seems to locate the lesion, in the majority of cases, in the arachnoid villi and the pacchionian bodies, with blocking of the foramina of Magendie and of Monro relegated to a secondary place. Other observers have expressed the belief that the principal site of absorption is along the arachnoid prolongation accompanying the cranial and spinal nerves [which may become involved].
>
> The hypothesis that hydrocephalus is produced by increased secretion, possibly attributable to interference with flow through the great vein of Galen, seems to have little support . . . It would seem that the hypothesis that hydrocephalus is produced by interference with the mechanism of absorption is supported by the great weight of evidence. Since this lesion may follow any inflammatory or obstructive lesion of the pacchionian bodies or arachnoid prolongations along the nerves, it must follow that hydrocephalus often means the presence of serious inflammation involving the dura and that either presence or absence of cells in

13. Williams, H. L.: Otitic Hydrocephalus, Arch. Otolaryng. **25**:632-652 (June) 1937.

the cerebrospinal fluid is not of major diagnostic importance. It is possible that in some stage of the development of acute hydrocephalus an increased cellular content of the cerebrospinal fluid will be a constant finding and that in some cases, as the inflammation recedes, the pressure of the hydrocephalus on the cranial sinuses, especially in the region of their exits through the cranium, is sufficient to establish a vicious circle and cause a continuation of the hydrocephalus by mechanical means.

These explanations of the syndrome called otitic hydrocephalus and described in an earlier paragraph are further amplified and coordinated by Shapiro.[14] He stated:

While the pathogenesis is by no means clear in every case, the majority of those observations which were made at operations or after histologic study indicated changes in the arachnoid membrane. The term arachnoiditis will therefore be used as a general name for the condition described.

There are many causes of arachnoiditis. According to Shapiro:

In the middle and especially in the posterior fossa all other causes are of subordinate importance to infection of the ear. This may be acute or chronic; even catarrhal otitis media has been considered as an etiologic factor. In many recorded cases the possible focus in the ear had long since cleared up by the time the symptoms of arachnoiditis became manifest.

. . . As the fluid is nearly always sterile, it is assumed that only the toxins reach the arachnoid membrane. "Minimal virulence," just enough to produce a mild inflammation, is therefore requisite for the occurrence of arachnoiditis.

. . . From a pathologic standpoint the following forms occur:

1. A fibrous and adhesive variety. This is common in the anterior but uncommon in the posterior fossa.

2. A cystic form. In this variety some part of the subarachnoid space, usually one of the cisterns, undergoes mild inflammation, resulting in obstruction of the normal circulation of the cerebrospinal fluid, with the formation of a pseudocyst in the affected area. Grossly the arachnoid membrane is thickened and opaque; histologically there is infiltration of round cells in the arachnoid mesh and in some cases of sclerotic changes in the underlying cortex. [Davis and Haven.[15]]

3. Internal hydrocephalus. This may be due to (*a*) inflammatory closure of one or more of the foramens in the ventricles, the aqueduct of Sylvius or the roof of the fourth ventricle, or (*b*) hypersecretion with so-called mechanical obstruction of the foramens.

4. Generalized intracranial hypertension. There is a free flow through the subarachnoid space, but the condition is due to (*a*) hypersecretion or (*b*) obstruction to the normal absorptive channels by inflammation of the arachnoid villi.

. . . it is well known, however, from both clinical and experimental evidence that under pathologic conditions the vessels of the pia-arachnoid may be stimulated

14. Shapiro, S. L.: Otogenic Aspects of Arachnoiditis, Arch. Otolaryng. **28**: 546-555 (Oct.) 1938.

15. Davis, L., and Haven, H. A.: A Clinical Pathological Study of the Intracranial Arachnoid Membrane, J. Nerv. & Ment. Dis. **73**:129 (Feb.); 286 (March) 1931.

to the production of cerebrospinal fluid. This fluid, however, differs from the normal fluid by showing an increased cell count and globulin reaction. This fact may serve to differentiate cases in which increased intracranial pressure is due to hypersecretion; if the fluid is clear the condition would be considered the result of some disturbance of the choroid plexus, while if there is an increased cell count it would be regarded as due in part to an exudate from the pia arachnoid.

Shapiro advised exploration of the dura if an abnormal collection of cerebrospinal fluid is suspected and if after a reasonable period there has been no improvement. The older authors (Warrington [16]) and some of the later ones recorded a number of fatalities apparently from continued intracranial pressure and, in several cases, optic atrophy following choking of the disk, which is nearly always present. This indicated that in cases with severe arachnoiditis watchful waiting is a virtue which can be practiced to excess.

An ingenious explanation for some cases of this entity was offered by Ersner and Myers.[17] To understand their reasoning, a short review of the anatomy of the cranial sinuses as presented by Barnhill [18] would not be amiss at this time. There are fourteen sinuses, excluding the basilar, which is more like a plexus. Of these, four are single and five are double. They are:

1. The superior longitudinal sinus, which is situated in the free margin of the falx cerebri and usually empties into the right lateral sinus.
2. The inferior longitudinal sinus.
3. The straight sinus, which runs from the inferior longitudinal sinus to the lateral sinus. It receives the great cerebral vein and the superior cerebellar veins.
4. The confluens sinuum, or torcular Herophili, which is located on the internal occipital protuberance and is formed by the junction of the superior longitudinal, straight, lateral and occipital sinuses.
5. The lateral sinuses, including the horizontal and the sigmoid.
6. The superior petrosal sinus, which empties into the sigmoid sinus at the base of the petrous portion of the temporal bone.
7. The inferior petrosal sinus which joins the sigmoid sinus where the latter rests on the jugular process of the occipital bone. The

16. Warrington, W. B.: Intracranial Serous Effusions of Inflammatory Origin, Quart. J. Med. **7**:93, 1914.

17. Ersner, M. S., and Myers, D.: An Aid to Interpretation of Intracranial Complications Resulting from Venous Circulatory Disturbance of the Temporal Bone Offered by X-Ray of the Lateral Sinus and Jugular Foramen, Laryngoscope **43**:800-818 (Oct.) 1933; Otitic Hydrocephalus with a Suggestion as to Etiology, Ann. Otol., Rhin. & Laryng. **45**:553-566 (June) 1936.

18. Barnhill, J. F.: Surgical Anatomy of the Head and Neck, Baltimore, William Wood & Company, 1937, p. 80.

junction of the two forms the beginning of the internal jugular vein. This drains the tympanum, cochlea, internal ear and aqueduct.

8. The occipital sinus, which begins at the foramen magnum, and communicates with posterior spinal veins and terminates in the torcular.
9. The cavernous sinuses, which are placed on both sides of the sphenoid body.
10. The emissary veins, which pass through apertures in the cranial wall and establish communications between the sinuses inside the skull and the veins external to it. Some are always present, others only occasionally. The principal emissary veins are the following: (*a*) the mastoid emissary vein, usually present, which runs through the mastoid foramen and unites the transverse sinus with the posterior auricular or with the occipital vein; (*b*) the parietal emissary vein, which passes through the parietal foramen and connects the superior sagittal sinus with the veins of the scalp; (*c*) a network of minute veins (rete canalis hypoglossi) which traverse the hypoglossal canal and join the transverse sinus with the vertebral veins and the deep veins of the neck; (*d*) an inconstant condyloid emissary vein, which passes through the condyloid canal and connects the transverse sinus with the deep veins of the neck; (*e*) a network of veins (rete foraminis ovalis) which unites the cavernous sinus with the pterygoid plexus through the foramen ovale; (*f*) two or three small veins that run through the foramen lacerum medium and connect the cavernous sinus with the pterygoid plexus; (*g*) the emissary vein of the foramen of Vesalius connects the same parts as in (*f*); (*h*) an internal carotid plexus of veins that traverses the carotid canal and unites the cavernous sinus with the internal jugular vein; (*i*) a vein that is transmitted through the foramen caecum and connects the superior sagittal sinus with the veins of the nasal cavity. This vein varies in size in different subjects.

In ordinary conditions, the bulk of the venous blood passes from the cranium by way of the lateral sinuses through both jugular foramens. The emissary veins carry normally only a small part of the intracranial venous blood.

Anatomic variations in the size of the jugular foramen were mentioned by Linzer, quoted by Seydell [19]:

> Linzer examined a large number [1,022] of skulls and found that 3 per cent . . . had an extremely small jugular foramen on one side. This finding occurred

19. Seydell, E. M.: Sinus Thrombosis, Ann. Otol., Rhin. & Laryng. **41**:466-492 (June) 1932.

five times more frequently on the left than on the right side. The foramen in these cases was too small to allow the passage of a vein that could establish collateral circulation, and undoubtedly severe reactions and perhaps death migh have resulted if ligation had been resorted to in these cases.

Kopetzky [20] wrote:

Law, before the Austrian Otological Society, presented an anatomic specimen of a right temporal bone which showed a strongly developed emissary vein running upward and posteriorly in a sulcus 6.5 mm. in width. The sulcus of the sigmoid sinus was entirely absent; the blood from the right transverse sinus emptied into the right emissary vein and not into the jugular bulb. From the emissary, the communication was with the superficial cervical veins direct. The left sigmoid sinus was markedly developed. In addition, the right middle and posterior cranial fossae were smaller than the left. He quoted Frey and Hoffman as having reported a similar observation in 1924.

The jugular foramen is a large aperture, formed in front by the petrous portion of the temporal bone and behind by the occipital bone. It is generally larger on the right than on the left side and may be divided into three compartments. The anterior compartment transmits the inferior petrosal sinus; the intermediate compartment, the glossopharyngeal, vagus and accessory nerves, and the posterior compartment, the transverse sinus and some meningeal branches from the occipital and ascending pharyngeal arteries.

In my possession is a skull (fig., *A*) on the left side of which (fig., *B*) a well outlined sinus groove, 11 mm. broad, leads from the internal occipital crest toward the jugular foramen. The latter foramen is spacious, 10 mm. in length and 7 mm. in width, with a large adjacent condyloid canal. There is no mastoid emissary foramen on the left side of this skull.

On the right side (fig., *C*) only a faint trace of a groove is present for the lateral sinus, and this trace of a groove ends at the mastoid emissary vein. No groove for the right sigmoid sinus is visible. The right jugular foramen is extremely small, 5 mm. in length and 2 mm. in width, with a small opening for the continuation of the groove of the inferior petrosal sinus, a small aperture for the ninth, tenth and eleventh cranial nerves and apparently no aperture for the sigmoid sinus. The size of the right condyloid canal is hardly one-third the size of the left condyloid canal.

Ersner and Myers [17] encountered 3 cases in which the lateral sinus was absent and 1 case in which the lateral sinus was present but was very small. They call attention to some of the mechanical and pathologic

20. Kopetzky, S. J.: Acute and Chronic Otitis Media and Sinus Thrombosis, Arch. Otolaryng. **12**:377-394 (Sept.) 1930.

phenomena, due to disturbed venous circulation. They pointed out that symptoms of circulatory disturbance due to venous congestion may include nausea, vomiting, edema of the superficial vessels of the scalp, and papillitis. There may be gradations from the simple to the most complex pictures with manifestations of ocular palsies, such as palsy

A, entire skull, sectioned; *B*, a detailed view of the left side; *C*, a detailed view of the right side. See text, page 926, for a detailed description of the anatomic features shown.

of the external rectus muscle and further degrees of optic neuritis, choked disk, various meningeal symptoms, such as Kernig's sign, Brudzinski's sign, rigidity of the neck and increased spinal fluid pressure. These symptoms are indicative of an increase of intracranial pressure.

The increase of intracranial pressure appears to be the natural outcome of an increased pressure within the cerebral veins which influence directly the pressure in the surrounding cerebrospinal fluid.[21]

There are several changes that occur in the vessels as a result of inflammatory reactions. The first is a primary and evanescent constriction of the vessels. This is followed by a more lasting dilatation. The increased rate of blood flow persists for only a short time and is replaced by a slowing of the current which may progress to complete stagnation.[21a]

The slowing of the blood current has been attributed to various influences, including alteration of the viscosity of the blood, swelling of the vascular endothelium, an obscure increase in the stickiness, and diminution in smoothness of the vessel lining.[21b]

Ersner and Myers [17] explained that in these circulatory disturbances resolution is favored when the contralateral circulation is adequate. If the venous congestion continues, there is a damming back of the blood into the petrosal and cavernous sinuses and other vessels, resulting in a reverse circulatory current, which will eventually extend to the veins of the opposite side. The contralateral circulation has to carry on the circulation for both sides.

If it so happens that the smaller side must bear the burden, then symptoms significant of intracranial pressure appear. Ersner and Myers related numerous instances in which roentgen films substantiated this statement. In the cases in which the side of the smaller sinus and jugular foramen was involved, the pressure symptoms were practically nil. In those in which the side of the larger sinus was involved, neurologic signs which are recognized as due to disturbance in venous circulation and to increase of intracranial pressure were present.

These authors emphasized that a stormy course, therefore, may be expected in cases in which the roentgen picture demonstrates marked difference in the size of the jugular foramens and in which the side of the larger foramen is involved.

In the second case to be reported herein, the roentgenograms showed a marked difference in the jugular foramens, that on the involved side being twice the size of that on the uninvolved side.

There are several theories of the genesis of otorhinogenic hydrocephalus, and in summarizing them I shall cite as examples those proposed in three excellent publications:

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21. Howell, W. H.: Textbook of Physiology, ed. 14, Philadelphia, W. B. Saunders Company, 1940, p. 630.

21a. Karsner, T. H.: Human Pathology, ed. 5, Philadelphia, J. B. Lippincott Company, 1938, p. 466.

21b. Karsner,[21a] p. 170.

Williams [13] indicated his theory, saying:

> It would seem that the hypothesis that hydrocephalus is produced by interference with the mechanism of absorption is supported by the great weight of evidence. This lesion may follow any inflammatory or obstructive lesion of the pacchionian bodies or arachnoid prolongations along the nerves.

Shapiro [14] went somewhat further by admitting that hypersecretion or obstruction of the normal absorption is one possible cause for general hypertension, but he cited as other possible causes the closure of the interventricular foramens or of the foramens of Luschka and Magendie. Besides this, he mentioned cases in which fibrous adhesive arachnoiditis or cystlike closure of some of the cisternae caused increase in the quantity and pressure of cerebrospinal fluid.

An ingenious explanation of the genesis of the hydrocephalus in some cases was given by Ersner and Myers.[17] They stated the opinion that if there is a difference in the size of both the sigmoid sinuses and the jugular foramens, the cause of the hydrocephalus lies in the disturbed and slowed-down venous circulation in the sigmoid sinus. In cases in which the side with the smaller jugular foramen and sinus is involved, there will be no increase in pressure; but if the larger sinus is involved, hypertension is the result.

Of course, none of these authors tried to explain all the cases of this relatively new syndrome, and probably every one of these explanations may be correct in some cases.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis in cases of otorhinogenic hydrocephalus is often exceedingly difficult. The condition must be differentiated from:

1. Brain abscess. Only the most careful weighing of every symptom can enable one to decide, and sometimes there is no other way out but to explore the brain. This when done carefully, through an aseptic terrain, is usually not very dangerous.
2. Sinus phlebitis.
3. Certain lesions of the posterior cranial fossa, such as tumors, nonotorhinogenic meningitis or ependymitis.
4. Otorhinogenic meningitis.
5. Miscellaneous conditions, including multiple embolism, thrombosis of the cerebellar artery, syphilis and tuberculosis, occurring in the presence of otitis media or infection of the paranasal sinus (Nielson and Courville [22]).

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22. Nielson, J. M., and Courville, C. B.: Pseudo Abscess of the Brain: Intracranial Disease During Otitis Media Simulating Encephalitic Abscess, Ann. Otol., Rhin. & Laryng. **43**:972-987 (Dec.) 1934.

TREATMENT

It is apparent that in most cases of acute hydrocephalus there is a favorable response to elimination of the exciting focus, with drainage of large quantities of cerebrospinal fluid by lumbar puncture. Some objections to spinal drainage have been raised on the ground that localized meningitis may thus become generalized. However, the experience of most otolaryngologists seems to be that if the exciting focus has been eliminated, generalization of the infection does not occur.

In many cases in which choked disk is a prominent symptom, one or two months have passed before papilledema disappears; and in some instances secondary atrophy of the optic nerve has taken place, with partial or complete blindness.

Oppenheim, in 1900, reported the rapid disappearance of choking of the disk after ventricular puncture, and this result has been obtained recently in several instances, as in 1 of my cases.

When papilledema is a prominent symptom and fails to recede under spinal drainage, especially if there is any failing of vision, the rapid relief afforded by ventricular puncture makes that the procedure of choice.

In most reported cases (Coleman,[23] Smith,[24] Rabbiner [25] and Gitt [26]), the surgeons used the aforementioned procedures.

With the advent of sulfanilamide and its derivatives, chemotherapy has become an important measure. After finding what germ is the exciting or causative factor, one should administer the indicated drug even though it does not work directly on the cerebrospinal fluid, which is sterile in cases of the type concerned here.

Chemotherapy helps in the elimination of the nidus of the germ in the pathologic fluid and tissues.

REPORT OF CASES

I wish to report 2 cases which will illustrate the aforementioned explanations of the disease, the symptoms and the treatment.

CASE 1.—A. O., a 12½ year old boy, entered St. Mary's Hospital on Dec. 26, 1931, complaining of a head cold of five weeks' duration, severe early morning headaches and copious discharge from the nose. On admission, both nostrils were discharging pus, but in the last week there had been discharge only from the right nostril. In the last three days, intermittent swelling had appeared over the right frontal region. The temperature ranged betwen 103 and 105 F.

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23. Coleman, J.: Otitic Hydrocephalus Pseudomeningitis, Laryngoscope **42**: 936-942 (Dec.) 1932.

24. Smith, C. H.: Otitic Hydrocephalus, with Report of a Case, Laryngoscope **44**:931-934 (Dec.) 1934.

25. Rabbiner, M.: Otitic Meningitis—Pseudo-Brain Abscess, Laryngoscope **45**: 676-684 (Sept.) 1935.

26. Gitt, J. G.: Otitic Hydrocephalus, Laryngoscope **50**:906-913 (Sept.) 1940.

He had had measles when 3 years old and several attacks of tonsillitis, which ceased after tonsillectomy and adenotomy were performed, at the age of 6.

Physical Examination.—The temperature was 105 F., the pulse rate 116, with regular rhythm, and the respirations 24. The patient did not look very ill. He was oriented in all spheres and had no ideational disturbances. The head was normal in contour. There was tenderness on pressure over the right frontal and ethmoid regions but no edema, no redness and no nuchal rigidity. The pupils were dilated but reacted to light and accommodation. The skin around the right nostril showed excoriations. The mucosa of the nose was markedly congested, and the right nostril discharged a copious amount of yellow pus. The nasal passages, however, were easily permeable. The pharynx was normal; the tonsils were absent Bilateral adenopathy was demonstrable on the anterior region of the neck. The lungs and heart were normal. On transillumination, the area of the right frontal sinus appeared dark. The roentgen diagnosis was acute frontal sinusitis and ethmoiditis on the right side.

Treatment.—The patient was treated conservatively with ice bag, ephedrine sulfate and rest. The temperature remained elevated to 104 and 105 F., and marked swelling appeared over the region of the right frontal sinus. On January 2 definite fluctuation was elicited.

With the patient under anesthesia induced with ether, an abscess was incised and explored. The middle portion of the anterior wall of the right frontal sinus was soft, rough and necrotic, with a fistula leading from the sinus to the periosteal abscess.

The necrotic anterior wall of the sinus was partially removed, enlarging the fistula a little. The sinus was filled with foul-smelling pus and granulation tissue. The nasofrontal duct was free and permitted the passage of a fair-sized cannula from the sinus into the nose. The mucosa of the sinus was left undisturbed. A rubber drain was placed into the sinus and the wound dressed.

Except for attacks of severe headache the patient was perfectly well for five days. Then, during a conversation with his parents, he suddenly lost the ability to talk. He did not lose consciousness. Examination revealed rigidity of the neck, Kernig's and Babinski's signs and right ankle clonus. The patellar reflex was hyperactive. The corneal and gag reflexes were normal. The abdominal reflexes were not changed.

Lumbar puncture yielded fluid under a pressure of 20 mm. of mercury, with no evidence of block. The cells in the fluid numbered 5 per cubic millimeter, 20 per cent polymorphonuclear leukocytes and 80 per cent lymphocytes. The Pandy test was negative. Sugar was present, 60 mg. per hundred cubic centimeters. The Wassermann and Kahn tests were negative. An ocular examination revealed a choked disk (+2 diopters). Examination of the blood showed the hemoglobin content 78 per cent, the erythrocytes 4,000,000 and the leukocytes 20,000 per cubic millimeter. A differential count revealed polymorphonuclears 80 per cent, lymphocytes 14 per cent, eosinophils 4 per cent and monocytes 2 per cent.

The day after the spinal tap was performed, the boy regained his ability to talk. He was oriented and could converse, though with slight hesitation. The choking of the disk did not diminish, and the attacks of headache continued. Two days later he once more lost his ability to talk coherently and mumbled continuously "Oh! gee!" The reflexes on the right were exaggerated, the rigidity of the neck and the Kernig sign reappeared.

On January 11 a second operation was performed. The wound was reentered, and the opening of the anterior frontal wall of the sinus was enlarged. The bony walls, especially the anterior and posterior walls of the frontal sinus, were necrotic; the mucosa was edematous, dirty gray and covered with granulations. During the removal of the mucous membrane, a large part of the loose and necrotic posterior sinus wall was curetted out. The dura behind the bone appeared normal.

Simultaneous lumbar punctures did not show any serious pathologic condition except a pressure of 19 mm. of mercury.

A few days after the second operation the boy became normal, and there has been no recurrence of cerebral symptoms. The choking of the disk disappeared slowly but was quite gone twenty-six days after the operation, when he left the hospital. The wound healed smoothly and the scar was hardly visible.

This case is a typical one of rhinogenic hydrocephalus caused by acute frontal sinusitis. My associates and I could not decide whether the hydrocephalus was caused by damage to the pacchionian bodies which partially stopped the absorption of the cerebrospinal fluid, or by slowing down of the flow of the blood in the longitudinal sinus and foramen caecum. Probably both factors influenced the increase in the pressure of the fluid and the production of the cerebral symptoms.

Case 2.—A white man 26 years old was admitted to the otologic service at St. Mary's Hospital on Dec. 3, 1937. His chief complaint on admission was of intermittent attacks of dull headache on the right side, which were most severe during the night, causing sleeplessness. He suffered from dizzy spells and nausea but never vomited or fainted. Since he could remember, there always was a serous discharge from his right ear, which became purulent when he had a cold. For the last four or five months the discharge had increased considerably in quantity.

He said that as a child he had had measles and chickenpox. At about the age of 11, a simple mastoidectomy was performed on the right side. One year before admission his tonsils were removed. Five months before admission, while driving a truck, he hit his head against the wind shield. He did not lose consciousness completely but was dazed. He was habitually constipated, suffered dyspnea on exertion, had rheumatic pain time and again and had swelling of the ankles and knees.

Physical Examination.—The patient was a well developed and well nourished man. His temperature was 100.2 F. and his pulse rate 92. The examination showed no pathologic condition except almost total destruction of the drum membrane of the right ear. There was considerable creamy discharge. The old scar of the mastoidectomy was not tender or swollen.

Treatment.—On December 4 a typical radical mastoidectomy was performed. No part of the dura or sinus was exposed during the operation. The progress was uneventful, and the patient left the hospital fourteen days later.

On January 7 he was admitted once more. He stated that he had been perfectly well until January 3, when his headaches returned and grew progressively worse.

Examination this time revealed a healed external mastoid wound. The epithelization in the ear was progressing satisfactorily, and the amount of discharge was not excessive. There were peripheral facial palsy on the right, a first grade horizontal nystagmus and slight disturbance in the coordination of movements of the right arm. There were increased reflexes on the right side, a slight Kernig

sign and rigidity of the neck. The temperature was 101 F. and the pulse rate 96. An ocular examination showed choking of the disk of + 2 diopters in both eyes. The right palpebral fissure was smaller than the left.

A spinal tap yielded clear fluid. The pressure was 21 mm. of mercury. The sugar amounted to 55 mg. per hundred cubic centimeters. There was no trace of globulin. The fluid contained 7 cells per cubic millimeter, of which 50 per cent were polymorphonuclears and 50 per cent lymphocytes. Culture of the fluid did not yield any growth. Examination of the blood showed the hemoglobin content 80 per cent, the erythrocytes 4,100,000 and the leukocytes 8,500 per cubic millimeter. The differential count revealed polymorphonuclears 69 per cent, small lymphocytes 29 per cent and monocytes 2 per cent. The urine was essentially normal.

Culture and smear of material from the ear revealed hemolytic streptococci.

Sulfanilamide was given, 50 grains (3.25 Gm.) daily. On January 13 the headache grew progressively worse. The patient moaned all day and all night. The nuchal rigidity increased. Kernig's sign was present, and the protruding tongue deviated to the left. A continuous coarse first degree horizontal nystagmus was present.

On January 14 the mastoid wound was reopened and the granulations curetted. The bone of the sinus wall, the bone anterior and posterior to the sinus and the tegmen tympani and antri were carefully removed piecemeal, and so was the adjoining squama. The exposed dura and sinus wall did not show any pathologic change.

The patient recovered quickly after the operation and sat up the next day. The facial palsy was not so prominent, the protruding tongue did not deviate and the headaches diminished. On January 18 the nuchal rigidity and headaches reappeared. At this time another spinal tap revealed essentially the same results as that done on January 7. On January 19 the facial paralysis, nuchal rigidity and Kernig sign disappeared. On January 20 a spinal tap yielded fluid under a pressure of 20 mm. of mercury. The spinal fluid contained 8 cells per cubic millimeter and 50 mg. of sugar per hundred cubic centimeters. After the tap the facial paresis was less and the headaches were diminished, but the choking of the disk was not diminished.

On January 26 facial paresis and nocturnal headaches returned. There were coarse first degree horizontal nystagmus and choking of the disk of + 2 diopters, and the protruding tongue deviated to the left. Sulfanilamide was given, 10 grains (0.65 Gm.) five times daily. On February 6 the patient complained of nausea but did not vomit. He became dizzy when he sat up in bed. Nystagmus, nuchal rigidity and the Kernig sign were present. The administration of sulfanilamide was continued, 10 grains (0.65 Gm.) five times daily. The hemoglobin content was 80 per cent, the erythrocyte count 4,150,000 and the leukocyte count 13,200, with polymorphonuclears 74 per cent, small lymphocytes 19 per cent, monocytes 1 per cent and stab cells 6 per cent. On February 14 examination by members of the staff of the neurologic department revealed paresis of the right facial nerve, asynergia and adiadokokinesis on the right side. The right shoulder was lifted more slowly, the head turned to the right more slowly and the grip of the right hand was weaker. There was decided hypesthesia of the tongue, the right side of the palate and the right side of the face. The right patellar reflex was absent and the left hyperactive. There were diplopia on looking upward and right, choking of the disk and astasia, with falling. The temperature was often subnormal (97 F.), and the pulse rate was 66. The impression given was that of cerebellar abscess, and exploration of the cerebellum was indicated.

On February 16 ventricular puncture was performed at a point 2.5 cm. superior to the external occipital protuberance and 0.75 cm. to the left of the midline. Large amounts of clear cerebrospinal fluid were evacuated. The trocar remained in place for nearly two hours, and so a thorough drainage of the cerebrospinal fluid was effected. As a second step, a T incision was made below the external occipital protuberance, and after the tissues were dissected from the bone, a circular piece of occipital bone, 3 cm. in diameter, was removed. The dura was incised and the cerebellum inspected. No pathologic condition could be detected. A trocar was then passed into the cerebellum at many different angles and through many different planes, but no pus was obtained. I closed the dura and soft tissues with black silk. A plaster of paris splint was applied to the head and neck.

After the ventricular puncture and the operation, there was steady improvement in the patient's condition. The temperature was 101.6 F., for the first two post-operative days, but then became normal.

On February 19 there was no facial paresis or nystagmus. The protruding tongue did not deviate. Choking of the disk was still present but diminishing.

On February 26 the patient was able to get out of bed. On March 1 he was able to walk. The choking of the disk disappeared. On March 12 there was no nystagmus or headache. The patient experienced slight double vision on looking to the right, but the optic disk was normal. On April 1 the double vision and choking of the disk had disappeared and the patient left the hospital. At the time of writing he comes regularly to my office. He has gained weight and is perfectly well.

This second case is a typical one of otogenic hydrocephalus. The roentgenogram of the skull showed that the left jugular foramen was definitely smaller than the right. It is easily possible, therefore, that in this case the hydrocephalus was caused by a slowing down of the blood flow through the involved right sinus carrying the biggest part of the blood out of the brain through the right jugular foramen. The patient received sulfanilamide for a long period. The administration of this drug did not seem to abbreviate very much the normal course of otorhinogenic hydrocephalus.

SUMMARY

Two cases of otorhinogenic hydrocephalus are presented.

Both patients were young persons, 12 years and 26 years of age, respectively.

In both cases the chief symptoms were increased pressure of the chemically and cytologically almost normal cerebrospinal fluid, headache and choking of the disk.

Both patients presented symptoms simulating those of brain abscess.

Different theories of the mechanism of otorhinogenic hydrocephalus appearing in the literature are presented. No one theory explains all cases of the disease.

Photographs of a skull are presented which show a very large left jugular foramen and a broad groove for the left lateral sinus, practically no groove for the right lateral sinus and a very small right jugular foramen.

CONCLUSIONS

The name "otorhinogenic hydrocephalus" seems to be better than "otitic hydrocephalus" for the syndrome described, because in some cases the condition arises from infection of the nose and paranasal sinuses.

The best treatment for otorhinogenic hydrocephalus is thorough elimination of the causative focus, administration of sulfanilamide or its derivatives and lumbar puncture. In some cases ventricular puncture is necessary. If the symptoms point very much to an encapsulated brain abscess, exploration through aseptic terrain is advisable.

INJURIES TO THE NOSE IN CHILDREN

DIAGNOSIS AND TREATMENT

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Since the nose is the most exposed feature of the face, it is natural that it bears the brunt of injuries, which accounts for the comparative frequency of nasal deformities as they are commonly seen. I am convinced that a large percentage of these deformities are results of traumas received in childhood at a time when the nasal structure is still incompletely developed. It is furthermore my opinion that a great many of these childhood injuries are unrecognized and untreated for reasons which will be elaborated a little later. A review of the case histories of 1,135 consecutive patients seen in private practice seeking nasal plastic procedures reveals the interesting fact that 323, or 28 per cent, gave a definite history of having sustained an injury to the nose in childhood. The actual percentage is undoubtedly much higher, since it is easily conceivable that in many cases the trauma was received so early in life that the memory of it was subsequently erased. In many cases even the parents had forgotten the incident or were ignorant of it. In addition to consideration of trauma received at the time of birth, it must be remembered that the child when he begins to learn to walk sustains innumerable falls, and although frequently the instinctive extension of the arms at the time protects him from facial injury there are many instances in which this protective reflex fails to act promptly to prevent a direct fall on the face. Also it should be remembered that during the school years, when the child indulges in competitive games in which falls and bumps are common, the nose receives its share of blows, which in many cases cause permanent deformity. Many children are reticent about reporting these injuries through fear of reprimand, and they are therefore unrecognized. I should like to point out that injuries to the nose react differently in children than in adults, because of the difference in structure. The nasal bones, the vomer and the perpendicular plate of the ethmoid are not completely ossified until puberty.[1] Since the nasal framework of the child is largely cartilaginous

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1. Peter, K.: Atlas der Entwicklung der Nase und des Gaumens beim Menschen, Jena, Gustav Fischer, 1913. Merkle, F.: Beiträge zur postembryonalen

(Footnote continued on next page)

or only partly ossified, trauma inflicted on it results either in incomplete fracture, analogous to the green stick fracture of long bones, or in bending of the nasal cartilages. Consequently the usual symptoms of mobility and crepitus are lacking except with more massive injuries. Yet the slightest displacement or bending of the incompletely ossified bones will result in an aggravation of the deformity as the child develops, until when he reaches the postpuberty period one finds it exaggerated beyond the worst expectations. The deformity may involve not only the external part of the nose but also the septum. Kurata [1a] in a series of experiments on animals showed that trauma to the bridge of the nose or continued pressure results in a bending of the septum which increases with the growth of the animal. Space does not permit my dealing fully with the disputed question as to the true etiology of septal deviations. I should like to point out merely that the old Zuckerkandl theory that deviations are the result of disproportion between the growth of the nasal roof and the upper jaw on the one hand and of the septum on the other is not entirely tenable in view of the more recent work of Schwartz,[2] Šercer [3] and Fuchs.[4] Schwartz's analysis of the septums in 84 pairs of twins led him to the conclusion that crowding of the septum during the period of development plays a minor part in the determination of its ultimate form, that the major factor is the character of the original anlage and that secondarily paratypical influences, including trauma, are factors of considerable importance. Šercer's interesting contributions bring out the fact that in the development of the skull when the sphenoid angle is less than 135 degrees and the Huxley angle less than 90 degrees, septal deviation is more common than when these angles are greater. In newborn infants, in Negroes, in native Australians and in prehistoric peoples, among whom these angles are wider than in the average modern civilized adult, septal deformities are extremely rare. Fuchs through a number of careful histologic examinations was able to show that trauma to the septal cartilage in infancy or early childhood causing even the least bending or thickening of the cartilage ultimately results in bony deviation as the process of ossification con-

Entwicklung des menschlichen Schädels, in Beiträge zur Anatomie und Embryologie als Festgabe Jacob Henle zum 4. April 1882 dargebracht von seinen Schülern, Bonn, 1882, p. 164. Keibel, F., and Mall, F.: Entwicklung des Skeletts und des Bindegewebes, Leipzig, S. Hirzel, 1910-1911, vol. 1, p. 435.

1a. Kurata, K.: Experimentelle Studien über die Aetiologie der Septumvariationen, Monatschr. f. Ohrenh. **72**:894 (Sept.) 1938.

2. Schwartz, M.: Die Formverhältnisse der Nasenscheidewand bei 84 Zwillingspaaren (53 eineiigen und 31 zweieiigen.), Arch. f. Ohren-, Nasen- u. Kehlkopfh. **119**:291, 1929.

3. Šercer, A.: Beiträge zur Entstehung der Septumdeformitäten, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **144**:77, 1937.

4. Fuchs, K.: Zur pathologischen Histologie der inneren Nase, Monatschr. f. Ohrenh. **66**:1077 (Sept.) 1932.

tinues and the newly laid down bone follows the plane of the cartilage which it supplants. Zuckerkandl himself [5] was not unmindful of the influence of trauma. He stated that many fractures are not diagnosed when they occur but are unmistakable when an examination later in life discloses ridges and irregularities, the result of irregular ossification. He also points out that subchondrial hemorrhage results in absorption of cartilage and substitution of fibrous tissue, which interferes with the normal process of growth.

These and many other observations all tend to show how significant an apparently minor trauma to the nose may be and how important it is to recognize it. The purpose of this paper, therefore, is to point out the signs and symptoms of injury to the nose in children and to suggest, as far as my own experience goes, various means of correcting the condition so as to prevent subsequent deformity.

It is important to remember that, because of the conditions already mentioned, when a child's nose has been injured the primary reaction is more marked than is usual in an adult (fig. 1). The edema sets in promptly and as a rule takes in the entire bridge of the nose, so that frequently it is impossible to determine the status of the solid structures. It has been my experience that physicians are inclined to minimize the real damage because of failure to examine the nose thoroughly before giving an opinion. They are misled by the smooth swelling and the apparent lack of signs indicating fracture or displacement, and as a rule their advice to the parents is to wait until the swelling disappears. This is a tragic error, because by the end of a week or ten days the malformation has already become fixed. The optimum time for intervention has passed, and the child is doomed to go through many years with a deformed nose before any one will have the courage to undertake its correction. This attitude is the result of misinformation based on the generally accepted dictum that a child's nose should not be operated on until at least the age of puberty. Before going any further, I should like to point out that many competent observers [6] have in the past few years definitely stated that a surgical operation on the nose may be safely undertaken at any age, without in any way impairing the future development of the organ. In behalf of these pioneers let me add my own support, feeble though it may be. It is my belief, based on quite a few years of experience, that a deviated septum or a twisted nose not only

5. Zuckerkandl, cited by Denker, A., and Kahler, O.: Handbuch der Hals-Nasen-Ohrenheilkunde, Berlin, Julius Springer, 1926, vol. 2, pt. 2, p. 452.

6. (*a*) White, F. W.: Submucous Resection of the Nasal Septum in Children, Arch. Otolaryng. **11**:415 (April) 1930. (*b*) Metzenbaum, M.: Dislocation of the Lower End of the Septal Cartilage, ibid. **24**:78 (July) 1936. (*c*) Carter, W. W.: Nasal Obstruction in Children Due to Septal Deformities, Laryngoscope **43**:377 (May) 1933.

can be but should be operated on in childhood if the deformity interferes with the normal functions of the nose.

Coming back to the main thesis, however, let the first consideration be the diagnosis of injury to the nose. I have already mentioned the initial edema, which comes on early and persists for a week or longer. Despite the masking effect of this symptom, it should still be possible to determine whether or not the nasal bones and cartilages have sustained a trauma sufficient to cause permanent deformity. One should be particularly careful to examine the septum, after adequate cocainization. Since in the majority of children the septum is free from deviations, one should look with suspicion on any angulation or bending of this structure after an accident, particularly if it is associated with

Fig. 1.—A patient's appearance a few hours after an injury was received. Roentgenograms showed a slight crack across the lower ends of the nasal bones (see fig. 6).

swelling. It is not uncommon to find subchondral hemorrhage in association with trauma of the nose, which can be easily diagnosed by the fact that the swelling fails to disappear after proper application of cocaine and ephedrine. Especially is this true when the swelling is bilateral. In fact, I consider this finding almost pathognomonic of damage to the septum. Such swelling must be speedily eliminated if permanent damage to the septum is to be avoided. It is not necessary to determine that the septal cartilage has been fractured, since in most cases the damage includes only a moderate bending of this structure and a subchondral hemorrhage. It is imperative that the mucosa be incised, the accumulated fluid drained off and the cartilage inspected for possible cracks or bends. If these are found, the deformity should be corrected by intranasal manipulation and the septum kept in the

midline by appropriate packs or wax plugs. In some cases the septal cartilage is dislocated from the vomerian groove and can be felt lying parallel to the latter on one or the other side. When detected within the first few days the dislocation can be reduced by lifting up the bridge of the nose from within with a blunt elevator while the cartilage is pried back onto the bone. Metzenbaum [6b] described this procedure several years ago, and a similar procedure was mentioned in the German literature. Yet there are few who remember it or think it worth while to employ. Naturally if one waits a week or more one will find that the conditions are not the same. Healing takes place rapidly in the child, and by this time a rather firm fibrous union has taken place, which makes the simple procedure difficult and often impossible. Besides, in many cases the vomerian groove is not normally developed because of developmental anomalies. If this is the case, one should not hesitate to elevate the mucoperichondrium on one side, separate the cartilage from the bone and try to replace the structures in their normal relations. If the cartilage refuses to slide back over the vomer one has the choice of either scooping out a groove in the vomer as suggested by Metzenbaum or chiseling off enough of the bone to permit the cartilage to swing back to the midline. When the trauma has been severe enough to cause a buckling of the cartilage with consequent depression of the lower half of the nose one will find it extremely difficult to carry out such a maneuver, especially in a very young child or if the patient is not seen in the first few days following the injury. Under such conditions, if one is to prevent a deformity, which is not only a handicap to the growing child but a reproach to the physician, every means possible should be employed to remedy the trouble. A very young child should be anesthetized and the nasal mucosa thoroughly shrunk with epinephrine or ephedrine before the incision is made. For a child over 7 or 8 years of age it is possible to do the operation with local anesthesia provided an adequate amount of barbiturate is administered. If a general anesthetic is employed it is well to pack off the choanae with a postnasal pack, keep the mouth open with a gag and have a good suction apparatus convenient for use in the nose. It is true that even under these conditions the bleeding exceeds that which takes place with local anesthesia and is often troublesome and obscuring. Yet with patience and adequate preparation with constricting agents it can be kept sufficiently under control to permit the necessary manipulations. At any rate, the procedure is not the classic submucous resection. Every effort is made to conserve as much of the cartilage as is possible. Only one side of the septal cartilage is bared, and the curves and bends are eliminated by slicing or hacking. If the septum refuses to go back to its normal position after this maneuver because of a sharp angulation or too wide a curve, it is safe to remove a narrow strip of cartilage to facilitate the reduction. At any rate, one will find that since the attached mucosa

of the opposite side insures the integrity of the cartilage, one can apply a considerable amount of force to the exposed cartilage as one maneuvers it back to the midline. I should like to point out in this connection that the mucoperichondrium strips off the cartilage much more readily in the child than in the adult, once the cartilage is reached. It is important that the initial incision be made cleanly with a very sharp knife (I prefer a small, round-bladed Bard-Parker) and sufficiently anterior, where its whole length can be seen. Other advantages of an anterior incision are that the membrane here is more cutaneous than mucous, that it is therefore firmer and less likely to tear when spread with the speculum and that it can easily be sutured at the close of the operation. I have found it helpful to inject the prospective field with procaine and epinephrine, whether the patient is put to sleep or not. The injection not only helps reduce the amount of bleeding but simplifies the elevation of the mucoperichondrium.

When the septum has been reduced, it is necessary to keep it in place and prevent further subchondral accumulation either with packing or with wax plugs. I have lately been using the cotton rolls that dentists employ and have found them easy to insert and remove. These rolls come in various thicknesses; so even the smallest nasal chamber can readily be packed without unnecessary trauma. I keep these rolls in a sterile container, cut them to the required length and cover them with petrolatum before inserting them. If there is a tendency for a septum to slide back into its previous distortion, particularly at its lower or free border, it can be held in place by a small roll of dental wax reenforced with a core of soft copper which is bent to counteract this tendency. This type of support can be left in place as long as a week without causing any reaction.

Coming now to the nasal bridge itself, the first consideration in a case of recent trauma is the diagnosis of fracture or displacement of the nasal bones. In a child over 7 years of age or in a case of severe injury the deformity may be apparent at the first glance and mobility and crepitus may be present. This is particularly true if the nose has been driven to one side or been depressed by the force of the blow. When such a deformity is present even the parents can see the change in contour and will remark about it. If in addition there have been external lacerations or loss of tissue, as is the case in automobile injuries, there can be no mistake about the diagnosis. However, it should be pointed out that external lacerations are not in themselves evidence of injury to the underlying structures and that one should not be led into the error of making a false statement in this regard. Positive evidence is furnished only by mobility of the fragments, crepitus and roentgenograms showing the lines of fracture. The roentgenographic examination is by all odds the most important means of diagnosis and should never be

omitted. It should be done at the earliest possible moment after the injury or as soon as the child's condition will permit and should be followed promptly by corrective procedures. In no case should a week be permitted to elapse.

In cases in which the nasal fracture is especially severe and associated with other injuries, it is often difficult and indeed inadvisable to attempt reduction of the fracture during the first few days, because the general condition of the child may be critical and the other injuries more threatening. Nevertheless, when the deformity is marked and obvious no time should be lost in making the diagnosis and attempting the reduction. At least the airway can be cleared and a broken septum replaced without subjecting the child to more than local anesthesia, and frequently the loosed fragments of nasal bones can be manipulated into approximately normal position without adding to the critical condition

Fig. 2.—A crushing injury to the nose was suffered, with displacement of the septum and external scars. The patient was untreated for over a month because of poor general condition and other injuries. The septum was straightened and the bridge restored with a costal autograft. The scar on the right side of the nose requires excision and a skin graft.

of the patient. Figure 2 shows what can happen when a deformity is entirely neglected. The picture on the left represents the appearance of the child one month after the accident. A concussion of the brain and other injuries seemed to the attending physicians to be good enough reason for leaving the nose alone. Consequently when I first saw the boy the bones had already healed in a vicious position, the septum was practically blocking both nares and the external scarring was ghastly. I am sure that had some attempt been made at the very beginning to replace the fractured elements and the lacerations sutured more carefully the deformity would not have been so desperate. An area of loss of skin over the right side of the bridge had healed by granulation, leaving an unsightly scar. This scar is still present, because the parents

are reluctant to permit a skin graft to be applied. However, I am hoping that they will change their minds as the boy grows older.

Despite what I have said about the incompletely ossified state of the bones, one can demonstrate fractures if the roentgenograms are taken properly. It is important to remember that the tissues being examined are thinner than those of the adult, and one should make due allowance by using a softer ray and shorter exposure than for an adult. It is

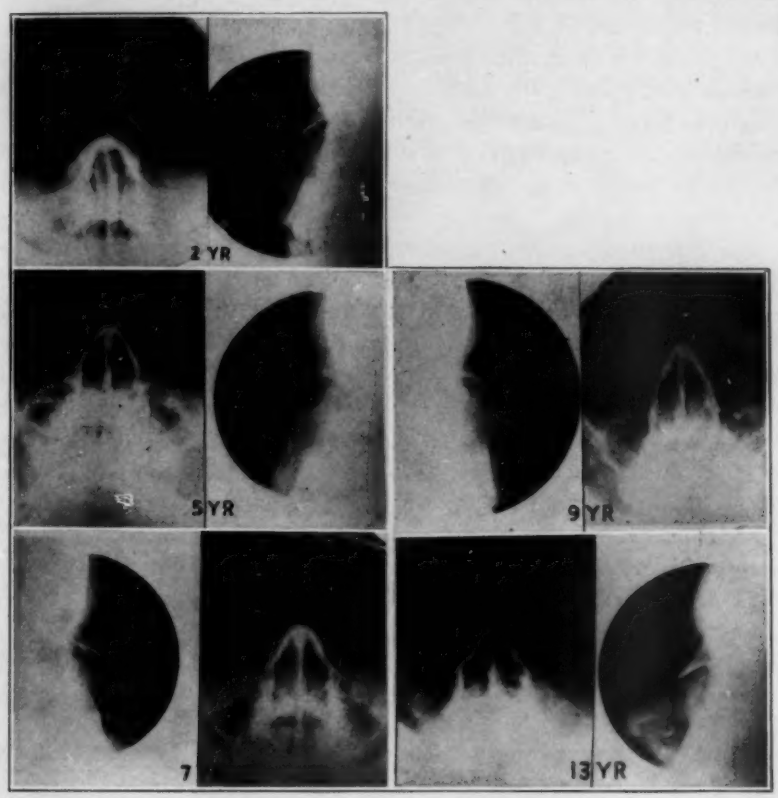

Fig. 3.—Roentgenograms of the nasal structures at the ages of 2, 5, 7, 9 and 13 years. The child aged 2 has a deviated septum as a result of a fall.

essential that the overlying soft tissues show up in the picture so that their relation to the bones can be clearly made out. I find that the two best projections are the lateral and the Waters position. The former will demonstrate the line of the dorsum, which normally is straight and follows the skin level (fig. 3). The least little crack in the bone can be easily seen, and when the fracture is comminuted the various fracture lines appear distinctly. One should not mistake for fractures lines the canaliculi which radiate from the root of the nose to the margin of the piriform aperture. These grooves are more marked the more

advanced the ossification and appear more regular and direct than fractures. The latter are as a rule either perfectly straight or irregular and jagged and are likely to run crosswise or diagonally. The Waters position shows the nasal bridge in cross section, so that it is possible to follow the plane down to the maxilla, and any irregularity in this contour must be accepted as evidence of injury to the bones. This is especially true if the bony contour fails to parallel the outline of the superimposed soft tissues, which should be seen clearly. Any bending outward or inward of the normal smooth curve of the nasal bones and frontal processes is an indication of injury, and even though there is no mobility or crepitus the condition should be treated as a fracture and an attempt made to restore the normal contour. The less the degree of ossification, the more likely it is that the bones have been bent rather than cleanly fractured and the consequences of neglecting such an injury may be as great as if the fracture had been complete.

The diagnosis having been completed and the evidence of trauma established, the next consideration is the treatment. Primarily, every effort must be made to limit the degree of swelling and to clear the nasal passages. Ice compresses and an ephedrine salt in saline solution applied frequently are effective when employed immediately after the accident. After twenty-four hours has elapsed the cold compresses have no value and may even retard resolution. The ephedrine solution may, however, be used as long as there is any tendency to swelling of the mucosa.

External evidences of the trauma should be corrected as soon as possible. Removal of grit, dirt and other foreign particles from the skin should be done carefully and scrupulously, in order to avoid permanent tattooing of the skin. If this is neglected one will find the task is infinitely more difficult when undertaken at a later date. An example of this is shown in figure 4. In this case the primary care was neglected and when the patient was seen a month later it was necessary to anesthetize him and practically denude the epidermis before the dirt marks could be eliminated.

Lacerations should also be carefully repaired, and when the alar or columnar cartilages are involved particular care should be taken to see that the approximation is accurate. There is nothing more disfiguring and more difficult to repair than an imperfectly healed nasal cartilage. The margin of the alae must be perfectly alined, and the tendency for the severed cartilage to curl must be overcome by through and through as well as superficial sutures. These points have been emphasized by Kazanjian,[7] Straith[8] and others[9] time and again; so they should be

7. Kazanjian, V. H.: Injuries to the Face and Jaws Resulting from Automobile Accidents, Tr. Am. Acad. Ophth. **38**:275, 1933.

(Footnotes continued on next page)

thoroughly appreciated by this time. Yet it has been my experience that the vast majority of physicians who see this type of lacerations for the first time are utterly oblivious of their importance. It should be thoroughly understood that such injuries as I have described are important enough to warrant hospitalizing the patient when the proper facilities are available. It is much better to defer the treatment until the conditions are adequate than to take a chance on hurried first aid. Most children require a general anesthetic for these procedures, and if competent anesthetists are available one will find intravenous administration of pentothal sodium satisfactory, since the patient falls asleep quickly and comes out of the anesthesia promptly and the anesthetist is not in the way of the surgeon.

The actual technic of the reduction of a nasal fracture is comparatively simple once the diagnosis is made. Combined intranasal and

Fig. 4.—Dirt and grease became ground into the skin. The patient was seen more than a month after the accident and required denudation of epidermis for removal of the dirt.

extranasal manipulation should be adequate. Any smooth, flat instrument, such as a Freer dull elevator, can be introduced within the nose and carried upward until it rests in the angle between the septum and the nasal bones, and with the fingers on the outside of the nose the surgeon can manipulate the bones into position. Only exceptionally is it necessary to employ much force. There are cases in which the nasal bones have been driven backward between the maxillas and others in which there is overriding of the fragments following trauma delivered from one side. Under these circumstances it is often necessary to exert considerable pressure within the nose to overcome the deformity. Fortu-

8. Straith, C. L.: Treatment of Traumatic and Acquired Facial Deformities, J. Michigan State M. Soc. **28**:431 (June) 1929.

9. Blair, V. P.; Brown, J. B., and Byers, L. T.: Early Local Care of Face Injuries, Surg., Gynec. & Obst. **64**:358 (Feb., no. 2A) 1937.

nately such conditions are less common in children than in adults. Yet when they occur they should be dealt with as vigorously in the former as in the latter.

In many cases of injury to the nose there is a slight depression of the lower ends of the nasal bones (fig. 5). If uncorrected this will result in a depression just below the bony ridge which looks like a saddle nose. When associated with a slight spreading of the nasal bridge it will leave the nose permanently thickened. Often this is also associated with a curvature of the septum. The entire picture can be changed by proper elevation of the fragment, replacement of the septum and application of an external splint that will exert some pressure along the sides of the nasal bridge. After the deformity is reduced the intra-

Fig. 5.—An untreated fracture two months after the injury. Note the width of the bridge and the depressed dorsum.

nasal packs or wax plugs may be introduced as required and the external splint applied. I realize that there are other methods of holding a broken nose in position which in some hands have yielded excellent results. However, in children, I find certain difficulties that seem to me to preclude their use. For example, the various types of external splint requiring application of a plaster cast to the head and application of pressure pads to the side of the nose have seemed to me to be too cumbersome for a child, and the pressure pads carry the danger of pressure necrosis. The through and through suture over lead plates advocated by Brown [10] may be effective in adults, but in several children

10. Brown, J. B.: Fractures of the Bones of the Face, Surg., Gynec. & Obst. **68**:564 (Feb., no. 2A) 1939.

for whom it was employed I found that the pressure marks persisted for a long time. I have been partial to the molded copper splint for a number of years, and since working out a method of insuring its remaining in place I have found it eminently satisfactory in children. The photographs in figures 8 and 9 illustrate the elements that go into the

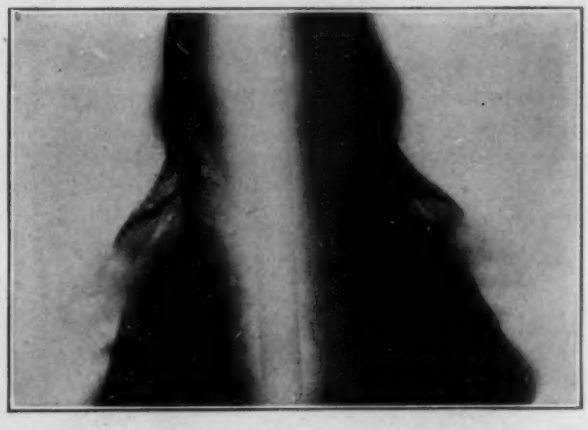

Fig. 6.—A slight crack is seen in the lower end of the nasal bones in a child of 7. There was no external deformity. (Roentgenograms of the patient whose photograph is shown in figure 1.)

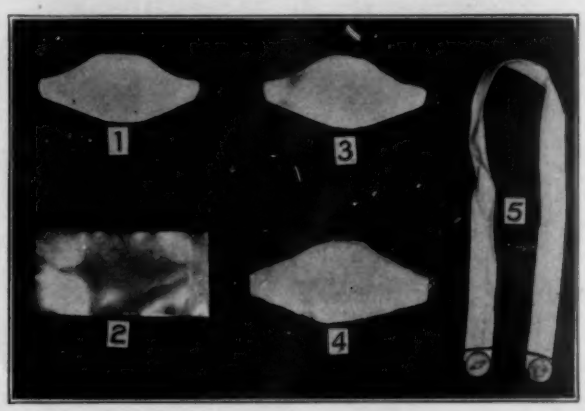

Fig. 7.—A copper splint assembly: (*1*) paper pattern; (*2*) sheet of copper 4 by 1½ inches; (*3*) copper cut to pattern and covered with adhesive tape; (*4*) cotton flannel slightly larger than the splint, used for padding; (*5*) adhesive tape folded on itself with buttons at the ends and a rubber band, applied from behind the neck to hold the splint in place.

making and application of the splint and should be self explanatory. The important points to be emphasized are the following:

1. A starched circular head bandage is applied rather firmly and permitted to dry thoroughly. This is usually done the night before or at

least four hours before the splint is attached. Its purpose is to afford a fixed point to which the adhesive strips holding the splint in place may be attached. It is light, easily borne and in this respect much better than plaster of paris or plastic material.

2. A pattern of the nose must be made that will follow the inferior margins of the orbit closely and come down the sides of the nose onto the cheek, since it is important that the splint rest below the malar prominences and not directly on the nasal bridge.

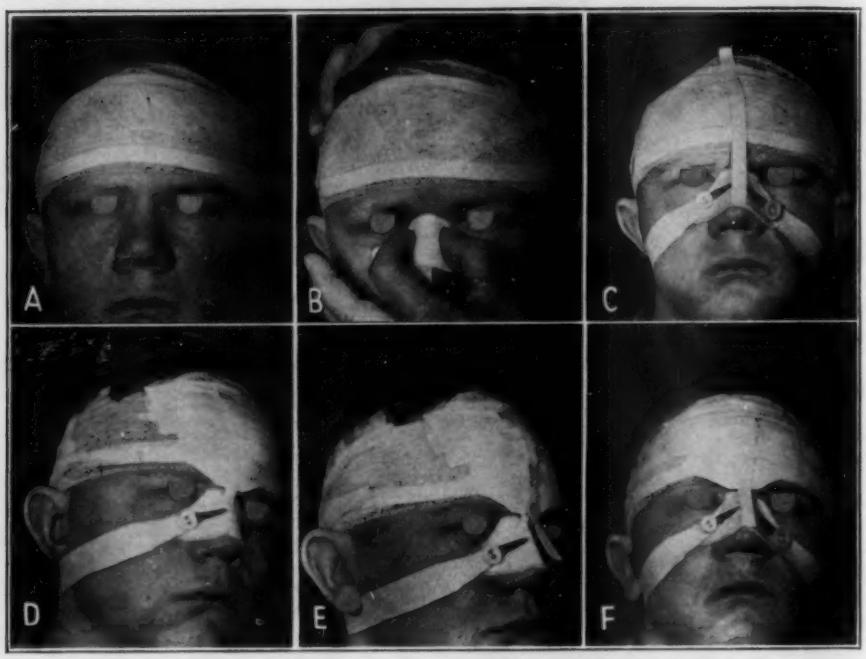

Fig. 8.—*A*, the starch bandage reenforced with adhesive tape when dry; *B*, the copper splint being molded to the shape of the nose (note the hanging piece of adhesive tape, which later serves to pull the splint upward); *C*, the splint in place (the "pull-up strip" holds the splint firmly against the root of the nose); *D*, cross strips of adhesive tape fastening the "pull-up strip" to the bandage and the splint itself; *E*, an extra strip of copper covered with adhesive tape and curved to follow the forehead and the nose attached for additional security; *F*, the fastening of the splint completed.

3. I use 14 ounce (400 Gm.) cold-rolled-annealed copper for the splint because it is soft enough to be molded by hand without forming ridges and yet stiff enough to hold its shape without exerting undue pressure. A piece of this copper measuring 4 by 1½ inches (10 by 3.8 cm.) is covered smoothly on both sides with one piece of adhesive. I have tried using moleskin but find it too thick for the purpose.

4. The splint is cut according to the paper pattern, and care is taken to see that the edges are smooth to prevent cutting into the skin.

5. For padding I use ordinary cotton flannel of medium weight, because it is smooth, soft, not too thick and easily cut to pattern. One or two layers are used, and they are cut to follow the splint, a margin of safety being left all around to protect the edges of the splint.

6. The splint is applied over the bridge of the nose and pressed down over the sides of the nose until it is felt to be smoothly applied over the entire bridge. The flared ends of the splint are then adjusted with the fingers and a pair of pliers so that they rest comfortably below

Fig. 9.—Above, a strip of copper laid on a sheet of dental wax; below, the wax wrapped around the copper and shaped to fit against the septum and prevent recurrence of luxation.

the malar prominences. When properly shaped and applied the splint should fit snugly against the extreme root of the nose; it should extend down below the piriform aperture and reach outward onto the cheek just below the infraorbital margins.

7. A strip of adhesive tape is attached to the upper end of the splint and carried down its length and left hanging while the splint is applied to the nose. I call this the "pull-up strip," because its function is to hold the splint firmly against the root of the nose and prevent it from sliding or tilting downward over the septal portion of the nose.

8. A broad strip of adhesive tape folded on itself to cover all the adhesive surfaces encircles the neck from behind and is cut to such a

Fig. 10.—A fracture reduced one week after the accident.

Fig. 11.—A recent nasal fracture with lateral displacement; reduction and application of a splint within three hours.

length that its ends are between 1 and 2 inches (2.5 and 5 cm.) apart when pulled firmly forward against the splint. This is usually measured and fitted and the buttons sewed on before the operation, so that it is ready for use when the splint is applied. A rubber band exerting a moderate degree of pressure is attached to the buttons, which holds the splint continually in place regardless of the position of the patient's head.

9. The pull-up strip is then brought upward so that the splint fits snugly against the root of the nose and is held there until it is firmly fixed with a number of cross strips. It is then folded downward, and again a row of adhesive strips is applied. Thus there is no chance of this important stay coming loose.

10. Now two small strips of adhesive tape are applied on the splint above and below the rubber band which holds it in one place.

11. Finally, for additional security, I fit a narrow strip of copper over the splint and extending up to the limit of the skull dressing, following the curve at the glabella and securing it with horizontal strips of adhesive tape. This prevents any tendency for the splint to pull away from the root of the nose.

When the technic just described is faithfully followed the splint will stay in place for a number of days and the only reason for changing it will be that it gets very dirty. Unless the patient has pain or the splint seems to be out of place there is no need of changing it oftener than once in three or four days. In most cases it is needed for seven to ten days. By that time the fragments have united sufficiently to be safe without any protection.

I wish to emphasize that the employment of this procedure will in many cases prevent the development of a broad nose as a result of bending or spreading of the soft nasal bones. The continuous and gradual pressure over the sides of the nasal bridge counteracts this tendency and eventually forces the bones to develop in their natural direction. It may be necessary to continue to use the splint for as long as three weeks, but I have never seen it do any damage provided it is carefully watched and adjusted according to the conditions present.

The treatment which I have described will be found adequate for the vast majority of nasal injuries in children. Only in exceptional cases, in which the trauma has been severe and the damage extensive, will it be necessary to resort to wiring or to the use of intranasal bars or a similar appliance. As I have already remarked, such conditions are rather infrequent in childhood, fortunately, and when they do occur the procedures indicated will be the same as for adults.

While the details of the treatment may seem complicated and perhaps superfluous, experience has demonstrated their importance. No doubt the procedure is capable of improvement and perhaps of simplification. I can only repeat that in my hands it has yielded excellent results.

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CEREBELLAR ABSCESS

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Otologists occasionally meet with cerebellar abscess as a complication of aural disease. It is as a problem of diganosis and management that I wish to present this subject.

The impressions recorded are based on experience with 11 patients, 5 of whom recovered, and on a comparison of their course with descriptions of the condition found in the literature. Most of these patients were under my care. In 2 cases I acted in the capacity of consultant, and in 2 I assisted in the management.

SYMPTOMS

The cerebellum may harbor an abscess and for some time fail to manifest localizing signs. This adds to the difficulty of diagnosing the lesion. There are, however, some general signs in a patient suffering from aural or mastoid disease which lead one to suspect the presence of a brain abscess of some sort and a cerebellar abscess in particular.

Appearance of the Patient.—One of these signs is a general appearance of serious illness out of proportion to the rather small rise in temperature. This is more marked than in a patient with uncomplicated mastoiditis. The most striking symptoms are depression of the sensorium and a listless attitude. Even when a great amount of headache is present, as elicited by questioning, the patient lies quietly, complaining little, moves lazily and answers questions slowly. Practically all of the patients observed by me showed these symptoms.

Headache.—Occipital and parietal headache is the chief complaint when the patient complains or is questioned on the subject. In 8 of the cases in my series it was a conspicuous symptom.

A striking sign is the cerebellar postural attitude assumed by the patient. Usually the patient is found in a semiflexed and relaxed position in bed, and almost always the position is the same. This sign was found in 8 of the patients I observed.

These are the most striking characteristics that attract the observer's attention and create suspicion of the presence of an intracranial lesion. From then on it is a matter of searching for signs sufficiently localizing to justify examining the brain.

Read before the Section on Otolaryngology, College of Physicians, Philadelphia, April 16, 1941.

Finger to Nose Test.—Among the most commonly found localizing signs is the incoordination elicited by the finger to nose test (present in 8 of the cases). It need not be well marked. While one must not overlook general weakness of the limbs in a sick person, there is no reason why this weakness should be unilateral and incidentally on the same side as the affected ear.

Most of the patients I have seen in whom a cerebellar abscess was found wavered only once or twice for a very short distance before locating the tip of the nose with the hand on the same side as the affected ear—but they promptly found the location with a finger of the opposite hand.

Nystagmus.—Another striking localizing sign is a coarse horizontal nystagmus, usually to the side of the diseased ear. It may change in direction. This was present in 9 of the cases.

Because labyrinthitis is often a forerunner of a cerebellar abscess and may simulate it, that condition must be differentiated. In labyrinthitis, however, the nystagmus is not horizontal but of a mixed rotary and horizontal type, more rapid and more often to the sound side. Frequently, recurrent nausea and vomiting are constantly associated symptoms with labyrinthitis, but they are milder and infrequent with cerebellar abscess. In the latter condition, nausea is usually absent, the vomiting being projectile. Vomiting was conspicuous in 4 cases. In labyrinthitis, moreover, the symptoms show a tendency to subside, while in a cerebellar abscess they tend to become worse.

Hypotonia.—Another sign is hypotonia (present in 5 cases). The muscles of the arm, for example, seem to have lost their tone, and the arm is more or less dragged up when it is moved, yet no marked weakness is present. The joints seem to move one after the other instead of the limb moving directly to accomplish its purpose. This is referred to as decomposition movement.

Facial Paralysis.—Facial paralysis is a sign which may help in localization. It is of the peripheral type and occurs on the side of the suspected lesion. In this respect, however, the cerebellar abscess must be differentiated, from a lesion in the mastoid bone. Four of the patients in my series showed this sign, and in 2 it was due to pressure in the posterior fossa. The paralysis disappeared when the posterior fossa was drained. In the other 2, the involvement was in the bone and drainage of the posterior fossa did not influence the paralysis.

These are the most striking diagnostic signs that are frequently present. Other signs must be looked for as a further help in diagnosis and localization. They depend on three factors:

1. Interference with cerebellar function, the purpose of which is the coordination of muscles and the maintenance of their tone. Besides

the symptoms already mentioned there may be (*a*) adiadokokinesis, or failure of the arms to coordinate movements simultaneously—the arm on the involved side lagging; (*b*) rebound phenomenon, or failure of the arm on the involved side to rebound after it is flexed, pulled and let go; (*c*) hypermetria, or overpointing; (*d*) occasional conjugate deviation of the eyes, and (*e*) clocklike speech, due to incoordination of the muscles associated with speech.

2. Vestibular disturbance. When a patient is not too sick to be subjected to vestibular tests, definite signs of a lesion of the cerebellopontile angle may be found. In a patient who had both a cerebellar abscess and an abscess of the parietal lobe, a vertical nystagmus in response to the caloric test was found ten days before any neurologic signs were detected.

3. Occasionally, pressure on neighboring organs by the abscess. This produces the following signs: (*a*) paresis of the external rectus muscle (in 1 case); (*b*) corneal anesthesia; (*c*) paresis of the tongue through pressure on the brain stem, involving the twelfth nerve (occasionally but rarely pressure on the pyramids causes homolateral hemiparesis); (*d*) involvement of the optic disks through increase in intracranial pressure following interference with the circulation of the cerebrospinal fluid at its exits from the fourth ventricle.

VALUE OF STATISTICS

In the management of this serious and comparatively infrequent condition, one depends a great deal on statistics. Statistics are undoubtedly of great value, as they summarize the past experiences of others as well as one's own experience. They are, however, frequently influenced by the personal interpretation and the reactions of the observer. For this reason it is unsafe to accept dogmatically any one observer's interpretation. One must have an open mind.

To be specific, it is almost taken for granted that brain abscess in general and cerebellar abscess in particular is associated with chronic aural disease in the vast majority of instances and with acute aural disease in only a small percentage of cases. In 8 of the cases in my group the patients were suffering from acute mastoiditis and otitis media for the first time.

ENCAPSULATION

For a long time "encapsulation" has been a magic word, and it has been dogmatically advised that in order to achieve safe results one must wait until an abscess is encapsulated before attacking it surgically. No good guide to the presence of encapsulation in available. Be that as it may—in 8 of my 11 cases no signs of encapsulation were apparent to a dull searcher, and strangely enough, in not 1 of the 5 cases in which there was recovery was there a capsule around the abscess.

WALLING OFF THE FIELD OF SURGICAL ATTACK

Much has been written about the use of coffer dams or of electrocoagulation around the area through which a search is to be made for an abscess.

After this procedure, according to the same advice, there should be two or three days of waiting before the brain is searched. All of this is done to prevent meningitis. Strangely, again, this was not practiced in any of the 5 cases in which recovery took place in my series. In 3 of the patients the abscess had already established communication with the dura (they were not extradural abscesses) and in 2 the brain was searched immediately on the first exposure of the dura. No disaster followed. On the other hand, I have a feeling that at least 2 of my patients were overtaken by disaster because of a twenty-four hour delay in searching. In 1 case in particular, acceding to the wishes of a neurologist who was influenced by the theory of delay, I waited for the day following exposure, to search the brain. Meanwhile, the patient died suddenly during the night. Next morning, when I examined the wound post mortem, I plunged a hemostat into the cerebellum to the depth of about ½ inch (1.25 cm.) and much to my chagrin released about 2 fluidrachms (7.5 cc.) of pus.

HISTORY

The history is often of value in making a diagnosis, notably a history of sinus thrombosis or of labyrinthitis, as these suggest the pathway of invasion. The first condition was present in 2 of my cases and the latter in 2 cases.

TREATMENT

All are agreed that the treatment of brain abscess is surgical. The controversy as to the time to institute surgical treatment and that as to the method of its application are far from settled. The large mortality rate alone testifies to that, for, regardless of the method of treatment, there are still deaths. It is therefore unwise to encumber one's judgment with dogmatic rules about encapsulation or walling off or any other such matter. Judgment based on the experience of one surgeon is as good as that based on the experience of another. There is bad as well as good in every one's judgment. Frankly, I cannot compromise with the dictum that knowing definitely of the existence of a collection of pus in the brain one is to sit down and wait for a probable capsule to form. To me the indication seems clear—drain it. I have a feeling that even those advocating the waiting procedure do not practice it, although they may violate it unconsciously. I have seen a surgeon of the waiting school drain an abscess two days after he advised waiting for encapsulation. Something happened, however, in the meantime. Central palsy of the facial nerve developed. This was the only localizing sign present. That surgeon

waited for a sign of localization because of uncertainty in his mind, but unconsciously he called it waiting for encapsulation.

I believe that one factor which influences a surgeon to wait is the fact that he hesitates to search the brain with the possibility of a negative result. However, when I consider the number of searches with negative results reported in textbooks and in the periodical literature in which the amount of damage feared was not caused, I believe it is safer to search and find nothing than to delay until damage has been caused by the abscess.

Another point to be considered is the presence of a capsule per se. It may not be a handicap and later could occupy space as a scar in the larger portion of the brain, or cerebrum, but there is little room for it in the cerebellum. In one of my cases which eventuated unfortunately, my greatest concern was what was to become of the capsule. After the abscess had been drained for several weeks, the patient having done well, the drain was removed, whereupon the cavity refilled. Later manipulation, to reinsert the drain, was followed by disaster. When an abscess is not encapsulated, the brain more readily contracts and helps to expel the tube gradually. The method of King is here brought to mind—in which the abscess is uncapped and allowed to herniate. If the patient recovers, the problem of the absorption of a capsule is non-existent. This method, however, cannot be practiced when the abscess is in the cerebellum.

About the question of walling off the area of approach to prevent meningitis, one may say that it may be practiced if one feels safer in doing it and the patient is in good general condition. If the patient is very ill, this procedure, in my opinion, is a dangerous waste of time. My feeling is that one should make up one's mind to drain the abscess and then drain it with the least possible manipulation and fuss.

The latter statement holds good when the method of drainage is discussed. The best consecutive results reported to the present are those of Macewen, who drained an abscess with a decalcified chicken bone. This is practically equivalent to the rubber tube used at present. The latter is my preference, although a wick of gauze is satisfactory. The gauze creates a channel and when it is saturated with secretions usually does not act as plug, as it is generally supposed to do. One of the best instruments through which to introduce the drainage tube directly into the cavity is the ingenious Grant cannula. This has a set of metal tubes contained within each other, and the outside one will permit passage of the proper sized tube; then the larger tube is withdrawn.

Once the drainage tube has been inserted, it is a poor policy to withdraw it or to manipulate it for a long time. It should not be disturbed for several weeks. The outer dressings should be changed frequently for cleanliness.

LOCATION FOR SEARCHING

The area in Troutman's triangle is the most direct and simplest route of approach. In view of the fact that the mastoid also must be cared for, it is unwise to drain the abscess posteriorly and wait for some future time to take care of the mastoid. After the lateral sinus is uncapped, sufficient room for satisfactory drainage may be made in Troutman's triangle. Herniation of the brain in that location is also less likely.

SUMMARY

Cerebellar abscess is discussed in the light of my experience with 11 patients, of whom 5 recovered.

The most striking general symptoms were an appearance of serious illness, marked depression of the sensorium and occipital headache.

The most striking localizing signs were incoordination as demonstrated by the finger to nose test, hypotonia and horizontal nystagmus to the diseased side. Other common signs are mentioned, such as facial paresis, adiadokokinesis, the rebound phenomenon and signs depending on pressure of the abscess on neighboring structures, e. g., paresis of the external rectus muscle, trigeminal involvement, influence on the tongue and choking of the disks.

The question of waiting for encapsulation of an abscess is discussed, as well as the advisability of walling off the area through which the abscess is to be drained for several days. Neither is considered to be of great importance, and both may be even dangerous in the cerebellum.

Rubber tubing is considered the simplest means of drainage, and manipulation of the brain tissue should be held to a minimun. It is advisable not to disturb the tubing for several weeks.

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ETIOLOGY OF BRONCHIECTASIS

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Cases of chronic disease of the lower respiratory tract attended by purulent sputum in large amounts show an overwhelming incidence of chronic sinus infection. In cases of bronchiectasis, both the incidence and the degree of sinus involvement are higher than in any other group of cases. Of the patients with bronchiectasis studied by Kern and me,[1] well over 90 per cent showed roentgen indications and 80 per cent showed clinical evidence of active sinus disease. The average number of sinuses involved per patient is very high, and in most instances there is pansinusitis.

Whether the disease is primary or secondary in patients with bronchiectasis usually cannot be determined. While chronic purulent sinusitis may initiate chronic bronchial infection and bronchiectasis, it is equally possible that the constant spraying of the pharyngeal structures by coughed-up sputum carries infection to the nasal chambers. Thus, purulent pansinusitis has been observed to develop in patients with post-tonsillectomy abscess of the lung in whom the sinuses were originally clear on both clinical and roentgen examination, all within a matter of weeks.[1]

The concept that sinus infection is primary and bronchial infection secondary is supported by experimental evidence. This evidence further indicates that infection within the sinuses may extend to the lower respiratory tract by more than one route:

1. When drainage from the infected sinuses is free, extension of the infection is apt to occur by inhalation. Mullin and Ryder [2] demonstrated conclusively that india ink or tubercle bacilli introduced into the nasal passages of animals may subsequently be found distributed along the respiratory tract as far as the terminal alveoli, with involvement of the bronchial lymph nodes in every instance.

Presented by invitation at the Sixty-Third Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 28, 1941, as part of a symposium on bronchiectasis.

1. Kern, R. A., and Schenck, H. P.: Chronic Paranasal Sinus Infection, Arch. Otolaryng. **18**:425 (Oct.) 1933.

2. Mullin, W. V., and Ryder, C.: Experimental Lesions of the Lungs Produced by the Inhalation of Fluid from the Nose and Throat, Am. Rev. Tuberc. **4**:683 (Nov.) 1920.

Quinn and Meyer [3] introduced iodized oil into the nasal passages of patients during sleep, and subsequent roentgenograms revealed the presence of the iodized oil in the lungs of nearly 50 per cent of the persons so treated, demonstrating the facility with which pus or infected secretions from the nasal passages may be aspirated into the bronchi. The frequency with which iodized oil is seen in roentgenograms of the lungs after it has been injected into the maxillary sinus offers further evidence.

2. A second route of infection from the sinuses to the lower respiratory tract is by way of the lymphatics and is of importance mainly when the drainage from infected sinuses is obstructed. Mullin [4] found that on lymphatic absorption of bacteria and of inert substances from the sinuses the transit took place by way of the submaxillary and internal jugular nodes to the lymph ducts, the great veins, the heart and finally the lungs. Larsell and Fenton [5] also have pointed out the possibilities of the extension of infection from the sinuses to the lungs by way of the lymphatics.

3. A third route of infection from the sinuses to the lungs is an indirect one, in which contiguous submucosal lymphoid structures first become involved and later infected secretions from the mucosal surfaces reach the lower respiratory tract by inhalation. Chronic sinus infection invariably leaves its mark on the pharyngeal lymphoid structures. Chronic infection of these structures frequently persists after the sinus infection becomes quiescent or inactive. Extension of infection from follicle to follicle may finally involve lymphatic structures which communicate with the mediastinum and the bronchial tree. The more obvious and more important mode of extension, however, is by frequent, repeated and direct inhalation of pharyngeal secretions into the bronchi and alveoli of the lungs.

EXPERIMENTAL STUDIES

Our experiments have convinced us that infectious material is readily transported from the upper to the lower respiratory tract and vice versa. Such transportation instead of requiring devious and somewhat academi-

3. Quinn, L. H., and Meyer, O. O.: Relationship of Sinusitis and Bronchiectasis, Arch. Otolaryng. **10**:152 (Aug.) 1929.

4. Mullin, W. V.: The Lymph Drainage of the Accessory Nasal Sinuses, Tr. Am. Laryng., Rhin. & Otol. Soc. **25**:73, 1919. Mullin, W. V., and Ryder, C. T.: Studies on Lymph Drainage of Accessory Nasal Sinuses, Laryngoscope **31**:158 (March) 1921.

5. Larsell, O., and Fenton, R. A.: Lymphatic Pathways from the Nose: Research Report, Arch. Otolaryng. **24**:696 (Dec.) 1936.

cally conceived lymphatic routes, appears to be brought about in one direction by inhalation and in the other direction by coughing.

Two of these experiments are cited to support the claim that infection is transmitted from the upper respiratory tract to the lungs with great facility:

Experiment 1.—Eleven normal adults (5 women and 6 men) were used as subjects. Because pharyngeal mucosa which has been subjected to long-continued contact with the material draining from infected sinuses is prone to be relatively insensitive, this condition was simulated by brushing the oropharynx and the nasopharynx with a 10 per cent solution of cocaine. Then each subject, while lying on his back, received 3 to 4 cc. of iodized oil in one nostril. After allowing a few seconds to elapse, in order that the iodized oil might reach the nasopharynx,

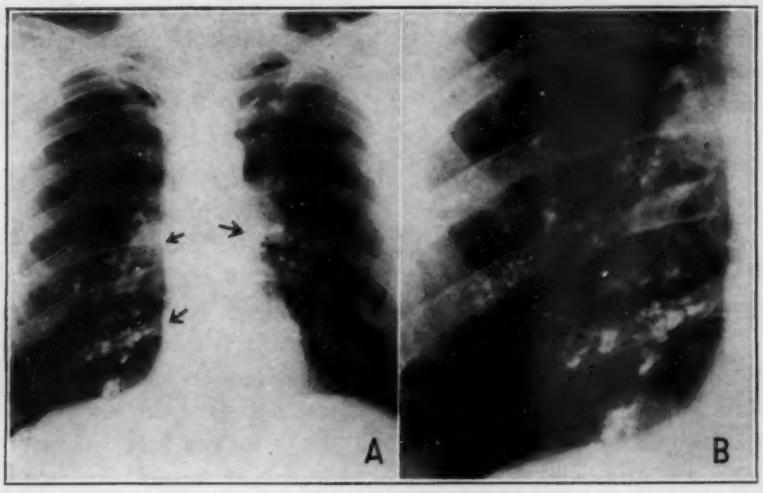

Fig. 1 (experiment 1).—Roentgenograms of the chest of an adult. In *A*, arrows point to iodized oil appearing in the bronchi after the introduction of an opaque medium into the upper respiratory tract. *B* shows in detail the distribution of the opaque medium.

the subject arose and walked to the roentgenologic department, where a roentgenogram of his chest was obtained.

Roentgenograms of 2 of the 11 subjects revealed the presence of iodized oil in the lungs, but roentgenograms taken of these 2 subjects twenty-four hours later did not. Neither of them coughed on arising to the erect position. Nine subjects whose roentgenograms failed to show opaque material in the lungs had coughed when they assumed the erect position. Figure 1 presents roentgenograms of the chest of an adult who had received opaque material into the nostrils. The roentgenograms demonstrate the presence of opaque oil in the lungs.

Experiment 2.—Twelve children, admitted consecutively to the hospital for removal of their tonsils and adenoid tissue, were selected as subjects. Each was operated on under general anesthesia. As soon as bleeding was controlled, the

patient received 4 to 5 cc. of iodized oil in one nostril. The patients were taken immediately to the roentgenologic department, where roentgenograms of the chest were obtained within fifteen minutes after the introduction of the oil.

Usually a period of five minutes was allowed to elapse between the introduction of the oil and the turning of the patient from the posture of lying on

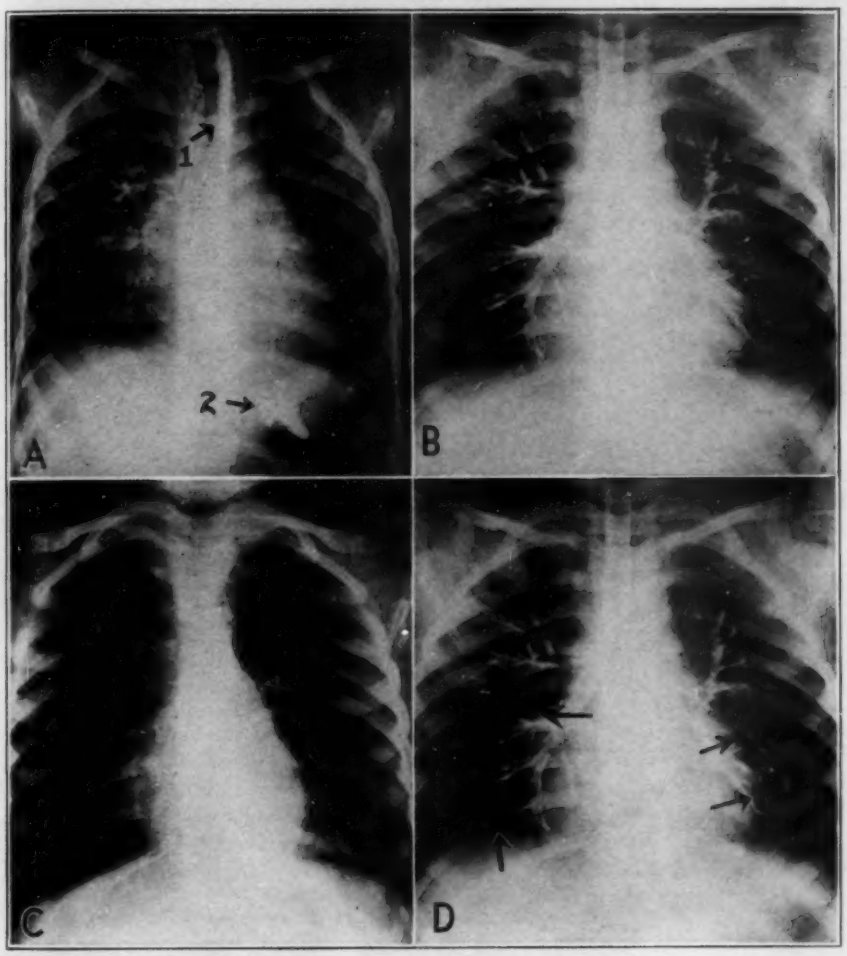

Fig. 2 (experiment 2).—Roentgenograms of the chests of 2 children. In *A*, *1* indicates iodized oil in the esophagus; *2*, iodized oil in the stomach. *B* shows the distribution of iodized oil in the bronchi after the opaque medium was introduced into the nose of a child under general anesthesia who had just undergone adenotonsillectomy. *C* shows the preponderance of iodized oil on the right side in a patient who was turned on the right side immediately after the introduction of the oil into the nose. In *D*, arrows point to blood aspirated into the bronchi of 2 patients under general anesthesia during an operation on the tonsils and adenoid tissues. The blood is seen as preventing extension of iodized oil into the distal parenchyma.

the back to permit escape of secretions from the mouth and throat. In a single instance the patient was immediately turned on the right side.

Two of the twelve patients were under unusually light anesthesia and recovered from the effect of the anesthetic while the roentgenograms of the chest were being taken. The roentgenograms revealed no opaque material in the lungs but did show some in the esophagus and in the stomach (fig. 2*A*).

The roentgenograms of the other 10 patients revealed the presence of iodized oil in the lungs. Moreover, the iodized oil was present in the lungs in large amounts and was widely distributed (fig. 2*B*).

The patient who had been immediately turned on the right side showed most of the opaque material in the right lung (fig. 2*C*).

In 2 instances blood also had been aspirated into the bronchi and was noted as obstructing further extension of iodized oil into the parenchyma (fig. 2*D*).

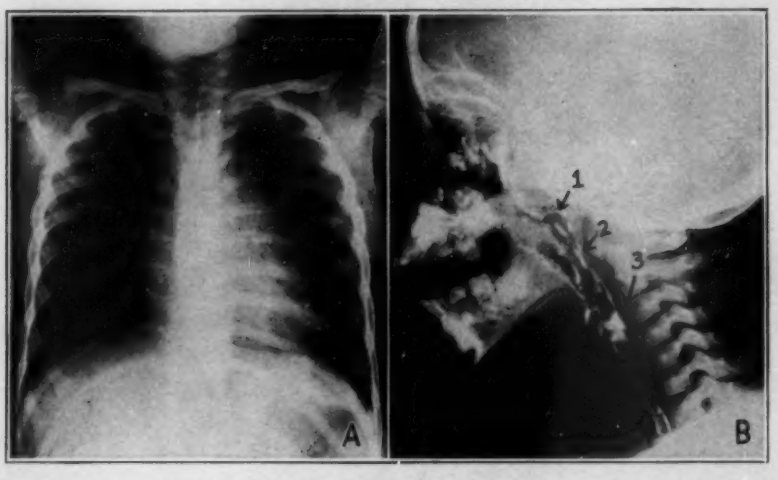

Fig. 3 (experiment 2).—*A*, roentgenogram of a normal child taken twenty-four hours after iodized oil was demonstrated in the lung. The material has been eliminated completely. *B*, roentgenogram of the head of a child after iodized oil was introduced into the nose at the close of an adenotonsillectomy performed with the patient under general anesthesia. *1* indicates the distribution of opaque oil in the nasopharynx; *2*, the distribution in the pharynx, and *3*, the oil filling the piriform sinus and spilling over into the trachea.

In every instance, roentgenograms showed that the iodized oil had disappeared from the bronchi within twenty-four hours.

That infection of the sinuses secondary to certain infections of the lower respiratory tract occurs has been denied because iodized oil introduced into the trachea was not delivered into the nasal passages by the ensuing cough. The transit of material, whether iodized oil or secretions, depends on many factors. Viscosity, specific gravity, temperature and other physical characteristics of the material to be transported modify the effects of the cough mechanism. That material at the level of the

larynx may reach the nasopharynx during coughing was demonstrated in experiment 3.

Experiment 3.—With a curved syringe, 5 cc. of iodized oil at body temperature was dropped into the larynx. If coughing followed the introduction of the iodized oil, a lateral view of the head was taken by a roentgenologist. Of 6 adults so examined, 3 showed roentgen evidence of iodized oil in the nasopharynx and 1, even along the floor of one nasal chamber.

Direct transportation of infectious material from the lower to the upper respiratory tract, however, does not seem to be necessary for

Fig. 4 (experiment 3).—Roentgenogram of the head of an adult, showing iodized oil coughed into the upper respiratory tract after its introduction into the larynx. *1* indicates oil along the floor of the nose; *2*, along the posterior nasal passage, and *3*, adhering to the pharynx.

infection of the sinuses. The delivery of infectious material to the pharynx occurs with traumatizing force. Under these circumstances it is unlikely that the pharynx long escapes infection, which subsequently spreads to the nasopharynx and thence along contiguous mucous surfaces to the nasal structures.

The use of iodized oil or other radio-opaque mediums to demonstrate the ready accessibility of the lower respiratory tract to infectious materials and to amplify knowledge concerning the mechanism involved

deserves further application. The observations of Iglauer [6] provide a firm basis for such studies.

The high incidence of sinus disease in cases of bronchiectasis is not likely to prove accidental. In those instances in which bronchitis or bronchiectasis is secondary to pulmonary abscess, the presence of a foreign body or tuberculosis, the clinical and roentgen findings differentiate the condition from bronchiectasis secondary to sinus disease, and accompanying sinusitis is then coincident or secondary to the pulmonary disease.

The greatest number of patients with bronchiectasis are in the first two decades of life, and of these patients the greater number are in the first decade of life. Goodale [7] has shown that a large percentage of those in the first two decades of life give a history of pneumonia in early life and that the remainder have had an unusually high incidence of infection of the upper respiratory tract. Pneumonia in childhood may predispose the lungs to infections derived from the sinuses. On the other hand, Campbell [8] pointed out the invariable presence of sinusitis in children with pneumonia. In other instances the sinusitis is first noted during an attack of an acute infectious disease, such as measles or whooping cough, and persists after the acute infectious disease has subsided. Experience has demonstrated the necessity for repeated examination of the chest and sinuses in every case of prolonged bronchiectasis.

One may hypothesize indefinitely concerning the mode of transmission of infection from the upper to the lower respiratory tract. In the final analysis, however, there is increasing evidence that the lungs are subjected to contact with material from the upper respiratory tract, that this occurs under a variety of conditions and that it occurs more frequently than was formerly suspected. There is little doubt that the material reaching the lungs by inhalation is often infectious. The important point is, why do some lungs undergo bronchiectatic changes while under similar conditions other lungs remain essentially normal?

The foregoing experimental observations indicated that the normal lung rapidly rids itself of iodized oil. Does a weak cough reflex eliminate the bronchial contents less efficiently than a strong one? It seems likely. On the other hand, anatomic variations in bronchial or parenchymal

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6. Iglauer, S.: Use of Iodized Oil in Roentgen Ray Diagnosis, J. A. M. A. **86**:1879 (June 19) 1926; Use of Iodized Oil in the Diagnosis of Pulmonary Lesions, Surg., Gynec. & Obst. **42**:82 (July) 1927; Evaluation of the Various Methods of Introducing Iodized Oil into the Tracheobronchial Tree, Bull. Kansas City Ophth., Otol., Rhin. & Laryng. Soc., March 1933.

7. Goodale, R. L.: An Analysis of Seventy-Five Cases of Bronchiectasis from the Viewpoint of Sinus Infection, Tr. Am. Laryng. A. **60**:195, 1938.

8. Campbell, E. H.: Incidence and Significance of Sinusitis in Pneumonia, Arch. Otolaryng. **20**:696 (Nov.) 1934.

structure, defects in the synchronization of respiratory movements, such as those which are known to occur in the epiglottis, or immunologic factors may hold the solution to the riddle.

From the practical standpoint it is obvious that the treatment of chronic suppurative disease of the lower respiratory tract is doomed to failure if it does not include the thorough treatment of sinus infection. Cure of the diseased sinuses will not always be followed by the arrest of the pulmonary lesions, and once the bronchial disease is well established, the eradication of sinus infection will not arrest the disease.

* The roentgen studies were made by Dr. Eugene P. Pendergrass.

BRONCHIECTASIS

MEDICAL ASPECTS

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It is only through the collaboration of the skilled roentgenologist, the bronchoscopist, the rhinologist and the thoracic surgeon that the internist acquires sufficient knowledge about bronchiectasis to justify his participation in a symposium devoted to the various aspects of this disease.

Bronchoscopy and bronchography have changed completely the conception of bronchiectasis which antedated the development of these methods. By their use it is possible to diagnose the congenital cystic, the atelectatic and the dry hemorrhagic types of the disease, in which characteristic symptoms may be absent, and the manifestations of the more usual acquired cylindric form may be visualized long before the condition progresses to a late and pathologically permanent stage. These diagnostic methods have made it apparent that in frequency bronchiectasis stands second only to tuberculosis among chronic diseases of the lungs.

ETIOLOGY

Congenital Bronchiectasis.—The greatest differences of opinion are expressed in regard to the congenital nature of bronchiectasis. Some authors deny the very existence of congenital bronchiectasis, excluding the fetal cystic type, while others believe that all bronchiectasis is congenital and that acquired infection of the bronchial tract does not produce bronchiectasis except in the presence of a congenital defect.

Congenital cystic disease of the lungs is really congenital bronchiectasis, because, as King and Harris [1] have shown, the walls of the cysts are composed of bronchial tissue, and the cystic fluid is a product of bronchial epithelium.

Atelectatic Bronchiectasis.—Those who believe that the atelectatic type of bronchiectasis is congenital emphasize the frequency with which

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Presented by invitation at the Sixty-Third Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 28, 1941, as part of a symposium on bronchiectasis.

1. King, J. C., and Harris, L. C., Jr.: Congenital Lung Cyst, J. A. M. A. **108**:274 (Jan. 23) 1937.

the so-called triangular shadow is found in roentgenograms of the chests of infants and children. Anspach [2] observed that at necropsy the bronchi of infants in whom the triangular shadow was present during life did not appear dilated. Warner and Graham [3] showed that the pathologic process producing the atelectasis in which bronchiectasis sometimes developed was an inflammatory swelling with blockage of the smaller bronchioles. In this connection it may be of interest that in 1924, just prior to the bronchoscopic demonstration of this fact, the opinion was advanced that obstruction of the bronchioles of an inflammatory nature is responsible for the constitutional symptoms of postoperative massive collapse of the lung.[4]

It may reasonably be concluded that although atelectasis is sometimes congenital, bronchiectasis does not occur as a congenital lesion in areas of atelectasis but may subsequently develop in them from infection and obstruction.

Dry Bronchiectasis.—The type of bronchiectasis usually referred to as dry hemoptoic or hemorrhagic occurs most often in adolescence and is characterized by no symptom but hemoptysis, which may be profuse and recurring. It is not known whether this type of cylindric bronchiectasis is congenital or acquired, but it has been reasonably well established that acquired infection produces granulation tissue in the bronchus and that this is responsible for hemorrhage.

Kartagener [5] described 19 instances of a symptom triad which bears his name and which in his opinion supported the congenital nature of bronchiectasis—the coexistence of bronchiectasis, situs inversus and a pathologic condition of the nose or sinuses, the latter being polyposis or hyperplastic ethmoiditis or both.

The simultaneous occurrence of this triad of symptoms with other congenital malformations lends further support to the belief in the congenital nature of this type of bronchiectasis.

However, it should be noted that in most instances many years elapsed between the alleged congenital development of bronchiectasis and the clinical manifestations of the condition. Furthermore, it is much more rational to suppose that nasal polyposis and hyperplastic ethmoiditis have their origin in infection than to believe that such lesions are congenital. The evidence in hand appears to support the

2. Anspach, W. E.: Atelectasis and Bronchiectasis in Children: Study of Fifty Cases Presenting Triangular Shadow at Base of Lung, Am. J. Dis. Child. **47**:1011 (May) 1934.

3. Warner, W. P., and Graham, D.: Lobar Atelectasis as a Cause of Triangular Roentgen Shadows in Bronchiectasis, Arch. Int. Med. **52**:888 (Dec.) 1933.

4. Leopold, S. S.: Postoperative Massive Collapse and Drowned Lung, Am. J. M. Sc. **167**:421, 1924.

5. Kartagener, M.: Das Problem der Kongenitalität und Heredität der Bronkiectasien, Ergebn. d. inn. Med. u. Kinderh. **49**:378, 1935.

belief that congenital bronchiectasis may be one of many congenital defects associated with situs inversus while polyposis and hyperplastic ethmoiditis are manifestations of an acquired infection which extends to the dilated bronchi and produces the symptoms of bronchiectasis.

Acquired Bronchiectasis.—The wet, suppurative forms of bronchiectasis classified pathologically as cylindric, saccular, fusiform and bronchiectatic abscess are considered to be acquired, because, regardless of a possible congenital defect, the symptoms result from infection.

A discussion of the causative factors in acquired bronchiectasis necessitates a somewhat detailed consideration of: (1) the relationship of infection of the upper respiratory tract to disease of the lower respiratory tract, (2) the role of certain infections as etiologic agents and (3) the influence of bronchial obstruction in the production of this disease.

The Relation of Disease of the Nasal Accessory Sinuses to Infections of the Lower Respiratory Tract: I have stated previously that it is difficult to overemphasize the role played by infection of the paranasal sinuses in the causation of bronchiectasis.[6] Infection of the entire tract may occur simultaneously, or the infection may progress so rapidly that all of the structures are involved during the course of a single acute infection. This condition Wasson[7] aptly called bronchosinusitis. In support of this conception Hodge[8] quoted Opie, who stated that sinus infection appears to be an almost invariable accompaniment of influenzal pneumonia.

The great frequency of infection of the paranasal sinuses in infancy and childhood was stressed by Ebbs,[9] of Birmingham, England, who performed autopsies on 496 unselected children from birth to 14 years of age. Sinusitis was present in 152 (30.6 per cent).

Necropsies of 200 children who died of pneumonia, also reported by Ebbs,[10] revealed gross infection of one or more of the nasal accessory sinuses in 85 (42.5 per cent). He then studied the pathologic changes in the lungs in these cases and found many of the changes to be chronic, a finding which permitted him to make a diagnosis of bronchiectasis.

Of 847 patients with bronchiectasis whose cases were reported by various authors, infection of the paranasal sinuses was found clinically or by roentgenogram in 72 per cent.

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6. Norris, G. W., and Landis, H. R. M.: Diseases of the Chest and the Principles of Physical Diagnosis, ed. 6, Philadelphia, W. B. Saunders Company, 1938.

7. Wasson, W. W.: Bronchosinusitis Disease, J. A. M. A. **93**:2018 (Dec. 28) 1929.

8. Hodge, G. E.: Relation of Bronchiectasis to Infection of Paranasal Sinuses, Arch. Otolaryng. **22**:535 (Nov.) 1935.

9. Ebbs, J. H.: A Note on the Incidence of Sinusitis in Children, Brit. M. J. **1**:385, 1938.

10. Ebbs, J. H.: The Relation of Upper Respiratory Tract Infection to Early Bronchiectasis in Children, J. Laryng. & Otol. **52**:849, 1937.

The routes of infection between the upper and the lower respiratory tract will be considered by Dr. Schenck. Suffice it to say that Mullin and Ryder [11] and Larsell [12] have demonstrated the pathways of lymphatic extension from the sinuses to the peribronchial lymph nodes and that McLaurin [13] and Quinn and Meyer [14] have shown that iodized oil placed in the nasal passages or antrums under appropriate conditions frequently reaches the bronchi.

Graham [15] reported an extremely important series of observations on the reaction of bronchial fistulas to acute infections of the upper respiratory tract. He observed a patient who had a fistula into one of the larger bronchi of the lower lobe of the lung after a pneumonectomy performed by cautery. Each time an infection of the upper respiratory tract developed, the exposed bronchial mucosa became red and swollen after about twenty-four hours and discharged pus. Cultures of material from the sinuses and from the bronchi usually yielded the same organ-

TABLE 1.—*Coexistence of Sinus Infection and Bronchiectasis*

Authors	Cases	Sinus Infection, per Cent
Olerf	200	82.4
Goodale	150	86.0
Perry and King	216	66.0
Walsh and Meyer	217	66.8
Quinn and Meyer	38	57.9
Dunham and Skavlem	26	73.0
Total number of cases	847	
Per cent of infection	...	72.0

isms. This clinical observation is fundamentally important in demonstrating the dissemination of infective material from the upper to the lower respiratory tract, although it is not possible to deduce from it whether this was accomplished by aspiration or by lymphatic extension.

Nunjester and Klepser,[16] in an ingenious series of experiments on white rats, produced pneumonic infection by the intranasal instillation of virulent pneumococci, having previously facilitated infection by the

11. Mullin, W. V., and Ryder, C. T.: Studies on Lymph Drainage of Accessory Nasal Sinuses, Laryngoscope **31**:158, 1921.

12. Larsell, O.: Lymphatic Pathways from Nose: Research Report, Arch. Otolaryng. **24**:696 (Dec.) 1936.

13. McLaurin, J. G.: Review of Interrelationship of Paranasal Sinus Disease and Certain Chest Conditions with Especial Consideration of Bronchiectasis and Asthma, Ann. Otol., Rhin. & Laryng. **44**:344, 1935.

14. Quinn, L. H., and Meyer, O. O.: Relationship of Sinusitis and Bronchiectasis, Arch. Otolaryng. **10**:152 (Aug.) 1929.

15. Graham, E. A.: Observations on Reaction of Bronchial Fistulae to Acute Infections of Upper Respiratory Tract, Am. J. Surg. **14**:382, 1931.

16. Nunjester, W. J., and Klepser, R. G.: A Possible Mechanism of Lowered Resistance to Pneumonia, J. Infect. Dis. **63**:94, 1938.

intrabronchial introduction of sterile mucin. They showed that both india ink suspended in sterile gastric mucin and virulent pneumococci reached the lungs of most of their animals when so-called factors of lowered resistance—deep ether anesthesia, alcoholic intoxication and severe chilling—were employed. In their control group, when the same materials were used, no particulate matter was aspirated into the lungs, and pneumonic infection developed in only a few animals. These results led the authors to study the mechanisms involved under the conditions of their experiments, and they found that deep ether anesthesia, alcoholic intoxication and cold interfered sufficiently with glottic closure to permit the aspiration of india ink suspensions and of pneumococci from the nose into the lungs.

The Role of Certain Infections as Etiologic Agents in Bronchiectasis: Influenza, measles, pertussis and bronchopneumonia are the infections most frequently associated with bronchiectasis. Bronchopneumonia complicating other acute infections is probably the commonest causative agents. It is doubtful whether pertussis can produce bronchiectasis by temporarily increasing intrabronchial pressure unless complicating bronchopneumonia adds the requisite factors of bronchial infection and obstruction. Lobar pneumonia is a less frequent cause than is generally supposed, because of its acute onset, short duration and the infrequency of delayed resolution. It has earned an undeservedly bad reputation as a common etiologic agent because the parenchymal spread of previous bronchiectasis may produce the physical signs of lobar pneumonia, leading to the supposition that pneumonia produced the bronchiectasis when the reverse was true.

The Influence of Bronchial Obstruction in the Production of Bronchiectasis: It is doubtful that any type of bronchiectasis occurs in the absence of obstruction somewhere in the bronchial tree. Inasmuch as obstruction from within by a tumor or a foreign body or from without by compression or cicatricial contraction is less common than infection anywhere along the tract, it follows that inflammatory obstruction is most often responsible for bronchiectasis. According to Erb,[17] the essential lesion is acute ulcerative bronchitis with destruction of the bronchial elements. The granulation tissue which is formed may become relined with epithelium. At first, healing may be prompted by bronchoscopic drainage. Later, when the bronchi become relined, healing is no longer possible, and bronchial dilatation occurs long before newly formed fibrous tissue contracts.

Greenfield[18] studied the changes in caliber of normal and bronchiectatic bronchi by fluoroscopic examination of the bronchial tree on deep inspiration and expiration after instillation of iodized poppyseed oil. He

17. Erb, I. H.: Pathology of Bronchiectasis, Arch. Path. **15**:357 (March) 1933.

18. Greenfield, J.: Bronchial Calibre Changes in Bronchiectasis, J. Clin. Investigation **19**:729, 1940.

concluded that conservative therapy was indicated only in those cases in which destruction of the flexible elements of the bronchi has not yet occurred. These studies and those of Erb support the belief that well established bronchiectasis is irreversible and that surgical treatment is indicated for its cure.

A better understanding of the causes of acquired bronchiectasis and of the pathways of the infections which produce it may be obtained by a critical examination of the published data regarding the lobar distribution of the bronchiectasis in comparison with that which has been recorded for solitary lung abscess.

Table 2 records the lobar distribution of bronchiectasis in 991 published cases. In 465 of the cases the left lung alone was affected; in 221, the right lung alone, and in 293, both lungs. In 40 per cent of

TABLE 2.—*Lobar Distribution of Bronchiectasis*

Authors	Cases	Left Lung	Right Lung	Both Lungs
Fletcher	100	43	25	32
Farrell	100	41	23	36
Perry and King	400	179	108	113
Wiese * †	114	50	11	41
Duken and von den Steinen *	167	103	32	32
Block and Francis	69	20	12	28
Boyd	27	15	6	6
Findlay and Graham	23	14	4	5
Total cases	991	465	221	293
Average per cent:				
Adults		40	22	
Children		54	15	

* Children only.
† Lower lobes only.

the adult patients the left lung alone was involved; in 22 per cent, the right lung alone. In 54 per cent of the children, the left lung alone was involved; in 15 per cent, the right lung alone.

Why does bronchiectasis involve the left lung almost twice as often as the right in adults, and why is there even greater predilection for the left lung in children? Before attempting to answer these questions, I shall compare the observations on the lobar distribution of bronchiectasis with similar reported observations of solitary lung abscess.

Table 3 records the lobar distribution of solitary lung abscess in 630 published cases; in 223 (35.5 per cent) of the cases the left lung alone was involved and in 407 (64.6 per cent), the right lung alone. Why does solitary lung abscess involve the right lung almost twice as often as the left? I shall attempt to answer this question first.

Evidence that aspiration is the usual mode of convection from the nose and mouth has been offered by the experimental studies of Quinn and Meyer [14] and of Nunjester and Klepser,[16] to which reference has been made. This evidence has been supported by the bronchoscopic

observations of patients after tonsillectomy reported by Myerson [19] and by Iglauer.[20] The evidence in favor of aspiration is contrary to the embolic theory of Fetterolf and Fox.[21] If these authors are correct, how is one to explain the fact that infective emboli, though multiple, almost always produces a single abscess and how is one to reconcile their theory with the tremendous difference between the incidence of lung abscess following tonsillectomy performed with the patient under general anesthesia and that following tonsillectomy performed with the patient under local anesthesia? It is agreed that foreign bodies and inspired material find their way more easily into the right lung because the right main bronchus is a more direct continuation of the trachea. This anatomic fact explains why solitary lung abscess occurs so often in the right lung.

It is more difficult to explain the fact that unilateral bronchiectasis is twice as common in the left lung in adults and more than three times

TABLE 3.—*Lobar Distribution of Solitary Lung Abscess*

Authors	Cases	Left Lung	Right Lung
Maxwell	199	79	120
Graham, Singer and Ballon	34	5	29
Hedblom	46	20	26
Norris and Landis	30	11	19
Flick, Clerf, Funk and Farrell	167	64	103
Chipman	33	6	27
Moore *	121	38	83
Total	630	223	407
Per cent		35.5	64.6

* Lower lobes only.

as frequent on the left side in children. Infection of the paranasal sinuses extends to the lower respiratory tract either by aspiration of infective material or by its absorption and transmission through the lymphatics. When bronchiectasis is produced by way of the lymphatics, the mathematical chances that infection will reach either or both lungs are equal. It is granted that the right lung receives infective material more readily; equally obvious is the fact that it drains more easily. Therefore, infective material is more likely to remain in the left lung, and that is why early bronchiectasis is usually limited to that side.

19. Myerson, M. C.: Pulmonary Aspects of Tonsillectomy Under General Anesthesia, Laryngoscope **32**:929, 1922.

20. Iglauer, S.: Aspiration of Blood into Larynx and Trachea During Tonsillectomy Under Local Anesthesia: Contribution to Etiology of Lung Abscess, Ann. Otol., Rhin. & Laryng. **37**:231, 1928.

21. Fetterolf, G., and Fox, H.: Reaction of Paratonsillar Tissues to Tonsillectomy: Study in Etiology of Post-Tonsillectomy Pulmonary Abscess, Am. J. M. Sc. **166**:802, 1923.

Duken and von den Steinen [22] stated that in children the left bronchus is narrower than the right and is more easily compressed at the place where it is crossed by the left pulmonary artery. This anatomic observation, if it is correct, accounts for the fact that unilateral bronchiectasis, although twice as common on the left side in adults, is even more frequently found on that side in children.

SUMMARY

The importance of bronchiectasis is attested by the fact that in frequency this disease stands second only to tuberculosis among chronic infections of the lungs.

The symptoms of bronchiectasis result from acquired infection, regardless of whether any particular type of the disease is congenital or acquired. Infections of the nasal accessory sinuses are the most frequent cause of bronchiectasis. These infections occur very often in infants and children, in whom they are particularly likely to be unsuspected.

The infections causing bronchiectasis usually are transmitted from the upper to the lower respiratory tract by lymphatic extension.

Infected material from the upper respiratory tract causing lung abscess usually reaches the lung by aspiration and is more likely to enter the right lung, because the right main bronchus is a more direct continuation of the trachea.

Because bronchiectasis usually develops from lymphatic convection of infection from the upper respiratory tract, the mathematical chances that the infection will reach either or both lungs are equal. The right lung, receiving infective material more readily, drains more easily. Therefore, infective material is more likely to remain in the left lung, and this explains why unilateral bronchiectasis is twice as frequent in the left side in adults. For certain anatomic reasons, which have been stated, unilateral bronchiectasis in children is three times as frequent on the left side.

CONCLUSIONS

1. The medical treatment of bronchiectasis is effective only before the pathologic changes in the bronchi become irreversible. Therefore, early diagnosis is essential for effective conservative therapy.

2. The internist, the pediatrician and the rhinologist must be constantly alert to the serious implications of infections of the upper respiratory tract in infants and children. When these infections are unsuspected, undiagnosed and untreated, bronchiectasis may develop and may progress so insidiously that all forms of therapy short of radical surgical procedure are merely palliative.

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22. Duken, J., and von den Steinen, R.: Das Krankheitsbild der Bronchiektasie im Kindersalter, Ergebn. d. inn. Med. u. Kinderh. **34**:457, 1928.

ROENTGENOLOGIC CONSIDERATIONS OF BRONCHIECTASIS

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In teaching and in the routine of large general hospitals, patients with symptoms suggestive of bronchiectasis are referred to the radiologist for investigation of those conditions that the clinician and the thoracic surgeon need to have clarified in order to decide what type of treatment shall be recommended. Some of the questions of interest are:

Does the patient have bronchiectasis? Does the disease involve the upper or the lower lobe of the lung, and if the disease is on the right side, does it involve the middle lobe? Is the process unilateral or bilateral? Is there hyperventilation of the lung fields or compensatory emphysema? Are there good expansion and contraction of the lungs and bronchial tree during forced respiratory efforts? Is there any displacement of the mediastinal structures? Is there fixation of the mediastinal structures? Is there good movement, relative restriction or fixation of one or both domes of the diaphragm? Is there any thickening of the interlobar or parietal pleura? Is there any roentgen evidence of disease of the paranasal sinuses? Is the esophagus normal?

The answers to most of these questions may be gleaned from a carefully planned conventional roentgen examination of the chest and upper respiratory tract. In many instances it may be necessray to introduce an opaque medium into the bronchi before one can determine whether bronchiectasis is present, the extent of the involvement and whether the process is reversible.

In order to discuss pertinent aspects of the roentgen diagnosis of bronchiectasis, it seems wise to review those phases of pulmonary dynamics and the roentgen appearances of structures that are modified by the disease process.

THE PLEURA

The parietal pleura is so thin that it does not cast a shadow which can be seen in a roentgenogram unless it is thickened and diseased or obliterates some portion of the costophrenic sulci. Very slight thicken-

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ing of the parietal pleura may be suspected when there is interference with the costal expansion, especially when the process is unilateral.

Only rarely do subcostal muscles produce a shadow that may be confusing. Knutsson [1] has described the roentgen appearance of these structures. On the posterior portion of the thoracic wall, the internal surfaces of the ribs are covered with subcostal muscles. In the lateral aspect of the thorax, the muscle lining disappears. The narrow layer of muscle on the inner aspect of the ribs produces a shadow which with one exception is seen only in the oblique view. This shadow becomes thinner from above downward and disappears entirely in the region of the costophrenic sulci. In pleurisy, which often accompanies bronchiectasis, the pleural thickening usually becomes thicker from above

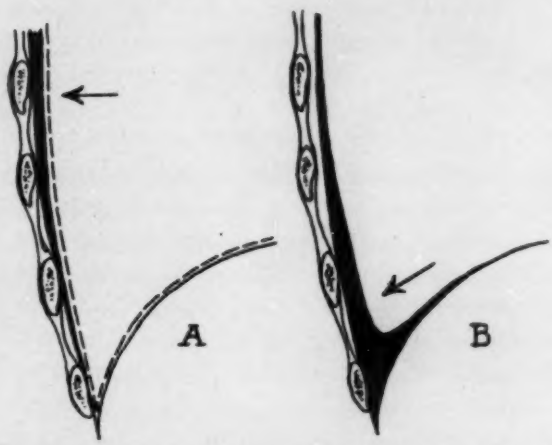

Fig. 1.—Schematic drawings. *A* demonstrates the decrease in the thickness of the subcostal muscles as they approach the diaphragm. The muscles are indicated by the dense black shadow. The interrupted line represents the pleura. *B* shows that the pleural thickening becomes more prominent near the costophrenic sulci. The pleural thickening is indicated by the black shadow (modified from Knutsson [1]).

downward (fig. 1) and may obliterate the sulcus. The thickness of the muscle shadow depends on the muscular development of the subject.

The visceral pleura covers the different lobes of the lungs and ordinarily does not cast a shadow that can be seen in a roentgenogram except in the instance of azygos and other accessory lobes. At times, straight and very thin shadows of the interlobar lines can be seen in roentgenograms of the chests of healthy persons. My colleagues and I have felt that such pleural shadows represent permanent thickening of

1. Knutsson, F.: Zur Kenntnis der normalen Röntgenologie der Pleura parietalis, Acta radiol. **13**:638-677, 1932.

the pleura from a preexisting infection. Furthermore, slight thickenings of the interlobar pleura are capable of producing shadows, because the roentgen rays are projected in their axial plane. This conclusion is supported by the frequency with which a shadow of the interlobar pleura is found in one of a pair of stereoscopic roentgenograms and not in the other. Any interlobar thickening not observed in an axial plane will nevertheless produce a shadow in the roentgenogram, which when superimposed on those of the pulmonary fields will create increased density. If this density is not recognized in its true relation, it may be mistaken for an intrapulmonary lesion. In disease, the visceral pleura rarely, if ever, becomes as thick as the parietal pleura. Clark [2] expressed the belief that when adhesions have formed, the increase in the thickening of the pleura in the lower part of the chest and around the heart as compared with that occurring in the upper part of the chest is due in part to the relatively more powerful movements of structures such as the domes of the diaphragm, the flaring of the ribs and the pulsation of the heart.

THE MEDIASTINUM

In roentgen examination of the chest, if the posteroanterior exposure is such that the roentgenogram will show the shadow of the trachea down to and including the bifurcation, the shadow of the lumen of the trachea will be fairly uniform, although the lumen decreases slightly from above downward. Just above the trachea, the laryngeal portion of the upper respiratory pathway is narrowed so that it produces a funnel-shaped shadow, with the apex of the funnel cephally placed. In children, the tracheal lumen may decrease as much as 50 per cent during expiration, although this decrease may not be very apparent in the roentgenogram.

The angles made with the trachea by the bifurcating bronchi vary with the age of the subject and from one another. In children, the right bronchus may form an angle with the trachea varying from 10 to 35 degrees, while the left bronchus forms one of 30 to 50 degrees.[3a] In adults, the angle of the right bronchus is approximately 20 degrees and

2. Clark, E. R.: Personal communication to the author.

3. Miller, W. S.: (*a*) The Lung, Springfield, Ill., Charles C. Thomas, Publisher, 1937; (*b*) Studies on Tuberculous Infection: II. A Description of Plastic Models (Reconstructions) of a Conglomerate Tubercle and the Surrounding Structures in a Human Lung, Am. Rev. Tuberc. **3**:65-85, 1919; (*c*) Studies on Tuberculous Infection: III. The Lymphatics and Lymph Flow in the Human Lung, ibid. **3**:193-209, 1919; (*d*) Musculature of the Finer Divisions of the Bronchial Tree, ibid. **5**:689-704, 1921; (*e*) Stereoroentgenograms of the Injected Lung as an Aid to the Study of the Lung Architecture, Bull. Johns Hopkins Hosp. **30**:34, 1919.

that of the left, 40 degrees. The eparterial bronchus sometimes branches directly from the trachea.

The shadows of the trachea and the right and left bronchi can be seen readily in the oblique and lateral projections of the chest. In the lateral view, the trachea may be followed from the suprasternal region down to its bifurcation. During inspiration, the entire trachea moves downward and slightly forward unless it is fixed because of mediastinitis. In children, the trachea buckles during expiration.

Under normal conditions, the heart in a thin person lies in the vertical position, whereas in the more stocky, broad-chested person, it assumes a more nearly transverse position. Normally, with the patient facing in a posteroanterior direction, the right border of the heart is formed, from above downward, by the right auricle, the inferior vena cava and the cardiophrenic ligament. In some patients, pads of paracardiac fat form part of the cardiac border. Roentgenographically, however, the shadow of the outline of the heart may sometimes be seen as a density within the less dense fat pad. The left cardiac border is formed by the pulmonary artery, the left auricle and the left ventricle.[4] With the patient in the lateral position, the anterior border of the cardiac silhouette is formed, from above downward, by the base of the aorta, the pulmonary conus and the right ventricle. The posterior border is formed, from above downward, by the arch of the aorta, the pulmonary artery, the left auricle, the left ventricle and the inferior vena cava.

I have included this brief description of the heart because in many cases of chronic unilateral bronchiectasis the heart is displaced toward the affected side.

THE DIAPHRAGM

The right dome of the diaphragm is about 1.5 cm. above the left dome in most instances. When transposition of the viscera occurs, the opposite obtains. In certain other instances, the shadow of the left dome of the diaphragm is either level with or above that of the right dome. Presumably in the absence of eventration or herniation such instances may be regarded as normal variants. In such instances the splenic flexure of the colon is usually highly placed, or there may be a large collection of air in the fundus of a cascade type of stomach, which is responsible to some degree for the position of the diaphragm.

In the anteroposterior and posteroanterior projections, the right and left halves of the diaphragm are dome shaped. The attachment of the mesial portions of the domes is on a higher level than the attachment

4. Margolies, A.: X-Ray of the Heart and Great Vessels, in Piersol, G. M., and Bortz, E. L.: Cyclopedia of Medicine, Philadelphia, F. A. Davis Company, 1932, vol. 3, p. 424.

to the ribs. This results in a costophrenic sulcus of varying depth. The domes of the diaphragm are regular in this plane, and any peaking during inspiration may be the result of either pleural adhesions or inelasticity of localized areas of the lung structures. The domes may be wavy at their outer aspect or produce a shadow of multiple arcs over the surface of the diaphragm because of variation in attachment or hypertrophy of the constituent muscle bundles. This has been described as individualization of the costal components. In the lateral view, the domes are higher anteriorly, and the posterior costophrenic sulcus is much lower than the anterior, rendering it possible for a relatively large localized pleural collection to escape detection in the dorsoventral roentgenogram. The upper surface of the shadows of the right and left domes runs from before backward. These shadows may be parallel or may cross each other either anterior or posterior to a point that corresponds to the middle of the domes. During the inspiratory phase of respiration, the shadows of the domes lose their dome shape and become relatively straight.

The movement of the domes of the diaphragm is extremely variable. The most accurate impression of this movement is obtained during ordinary respiration. Frequently, efforts to study diaphragmatic excursion during forced respiration are confusing on account of the influence of the costal and abdominal muscles. The movement of the domes of the diaphragm is usually more pronounced in men than in women. The domes are higher and the excursion is greater when the subject is in the horizontal posture than when he is in the erect. Therefore, any one interested in detecting slight restriction in movement should examine the subject in the erect posture. This is particularly true in the examination of infants and young children.

THE SHADOWS OF THE HILUS

The structures in the hili include the bronchi, the pulmonary arteries and veins, the tracheobronchial and aortic lymph nodes, the nerves and the connective tissue. The lymph nodes are classified as follows: (*a*) bifurcation nodes, located between the right and the left main bronchus; (*b*) tracheobronchial nodes, situated above the bronchi and along the trachea; (*c*) the aortic nodes, and (*d*) the paravertebral nodes.

The shadow of the hilus is irregular in outline, with ill defined borders. The density of the hili as seen in roentgenograms, varies considerably with the type of roentgenographic exposure. In an arbitrary, properly exposed roentgenogram, the shadow has varying densities and is not homogeneous. It seems that if roentgenologists could agree on what constitutes a properly exposed film, varying densities could be

regarded as significant observations. We have placed considerable reliance on individual ability to see varying densities in the shadow of the hilus, i. e., the bronchial shadow is different from that of the vessels. When the density of the shadow is more or less homogeneous, it is our impression that one can be fairly certain that abnormal changes have become manifest.

The National Tuberculosis Committee [5] has described the limits of the hili as follows:

On the right side, the normal shadow may be said to extend, from above downward, from the top of the right main bronchus to approximately a point where the bronchus of the lower lobe of the right lung, below the origin of the middle lobe trunk, begins to subdivide into its lower lobe branches (or trunks). This includes the anatomic hilus, the greater portions of the larger bronchi and some lung tissue in front and behind. The extent of this hilar shadow from above downward is approximately two interspaces and a rib.

On the left side the pulmonary artery passes above the left bronchus. From above downward the shadow of the left hilus may be said to extend from the upper border of the pulmonary artery approximately to a point where the bronchus of the lower lobe of the left lung begins to subdivide into its lower lobe branches (or trunks). The hilar shadow on this side is slightly shorter than the one on the right and is slightly less than two interspaces and one rib in length.

While the top of the right bronchus is higher than that of the left, if the tops of the hilar shadows are limited in the manner just described, they are on a plane approximately level.

The thickness of the hilar shadow in the anteroposterior direction is a matter that requires further study, and probably largely from the lateral view. Measurements from lateral views are uncertain and subject to the personal equation. One should learn to acquire the idea of depth as well as length and width when interpreting hilar shadows.

THE ZONES

The chest has been variously divided into different zones for convenience in describing the single film. The classification in most frequent use is that which divides one side of the thoracic cavity into three zones: the inner, or hilar; the middle, or truncal (or vascular), and the peripheral, which contains the finer subdivisions of the vascular tree, in which the only shadows visible consist of fine linear markings.

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5. Pancoast, H. K.; Baetjer, F. H., and Dunham, K.: Studies on Pulmonary Tuberculosis, Am. Rev. Tuberc. **15**:429-471, 1927; Am. J. Roentgenol. **17**:507-527, 1927.

In describing stereoscopic films, there is little occasion to use such a classification except so far as the various zones have different capacities for expansion.[6] The hilar zone expands and contracts less than the truncal, or vascular, zone, and the peripheral zone has more expansile and contractile power than the truncal, or vascular, zone.

THE LOBES

Ordinarily, the right lung is divided into three lobes and the left into two. Not infrequently, there is an accessory lobe on the right side, called the azygos lobe. This lobe is recognized by a fine pleural line which extends from the apex of the lung downward, to end as a dense oval shadow near the upper aspect of the right border of the superior mediastinum. The dense oval shadow is due to the azygos vein, which maintains its fetal position and carries with it a reflection of the parietal pleura down to the point of entrance into the superior vena cava. The size of the azygos lobe is variable, depending on the position of the vein.

More recently, other accessory lobes have been described in roentgenologic literature.[7] An accessory lobe, partially or completely formed, is occasionally found at the base of each lung. These lobes are variable in size and represent division of each lower lobe. They can be recognized by the presence of interlobar pleural shadows extending upward from the mesial portion of the domes of the diaphragm toward the hili. An accessory lobe is occasionally the site of a pathologic process, such as bronchiectasis, and then is readily recognizable. On one occasion, we observed two lobes only on the right side. The observation was confirmed by postmortem examination.

The position of the various lobes is readily observed in instances in which interlobar shadows are visible or after the introduction of an opaque medium into the bronchi. It should be emphasized, however, that the size and the extent of the lobes are variable. Occasionally, the lower lobes may extend very high posteriorly, so high that physical signs and even shadows in the roentgenogram may be misinterpreted as representing lesions in the lower portion of the upper lobe.

THE VASCULAR MARKINGS

Extending from the hilus on either side are heavy shadows which pass into each lobe. These shadows are more pronounced in the lower

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6. (*a*) Keith, A.: Respiration in Man, in Hill, L. E.: Further Advances in Physiology, London, Edward Arnold, 1909. (*b*) Macklin, C. C.: X-Ray Studies on Bronchial Movements, Am. J. Anat. **35**:303-329, 1925; (*c*) Dynamic Bronchial Tree, Am. Rev. Tuberc. **25**:393-417, 1932.

7. Rigler, L. G., and Ericksen, L. G.: Inferior Accessory Lobe of the Lung, Am. J. Roentgenol. **29**:384-392, 1933.

lobes and in roentgenologic literature are described as truncal shadows. It has seemed to me, however, that this term conveys the impression that a bronchus is responsible for, or at least associated with, these visible shadows. From the work of Miller,[8] Miller [8] and Greineder [9] it seems that such an interpretation may not be correct. For years, roentgenologists attempted to localize foreign bodies and lesions according to the distribution of these shadows as they passed into each lobe. It was recognized that only very large bronchi were visible, and these were restricted for the most part to the hilar zone. On the other hand, roentgenologists thought that the truncal shadow as seen and described in the roentgenogram represented the bronchus, artery, vein, nerves, lymphatics and connective tissue. Wherever one of the large branch

Fig. 2.—Roentgenogram of excised lungs. The lungs were insufflated with air before they were removed from the thoracic cavity. On the right side the pulmonary vessels were ligated, to prevent the drainage of the blood from the vascular system. Note the prominence of the vascular markings. These vascular markings as seen on the ordinary roentgenogram are commonly referred to as trunk shadows. On the left side the blood was allowed to run out of the pulmonary vessels, but the vascular markings are not as prominent as those on the right side.

shadows was seen, there was thought to be a bronchus. It is known now that this is not the case (fig. 2). Miller [8e] has shown that

> . . . the pulmonary artery follows, in all of its subdivisions, the subdivisions of the bronchial tree. As each main branch of the pulmonary artery arches over its corresponding stem bronchus, it comes to occupy a position posterior (dorsal) and slightly lateral to the bronchus. The relation of the main trunks of the

8. Miller, G. R.: Recognition of Thoracic Calcification, Am. J. Roentgenol. **26**:191-201, 1931.

9. Greineder, K.: Die Tomographie der normalen Lung, Fortschr. a. d. Geb. d. Röntgenstrahlen **52**:443-461, 1935.

pulmonary vein to the bronchi is quite different; they are situated anterior (ventral) and mesial to their stem bronchi and in their ultimate distribution are situated as far removed from bronchi as possible.

Miller,[8] interested in another phase of the same subject, made similar observations, as did Greineder,[9] with even more striking demonstrations by tomography (fig. 3). If one can be certain that veins as a rule have a larger diameter than arteries, it is my belief that the shadows of the larger veins can be differentiated from those of the larger arteries in

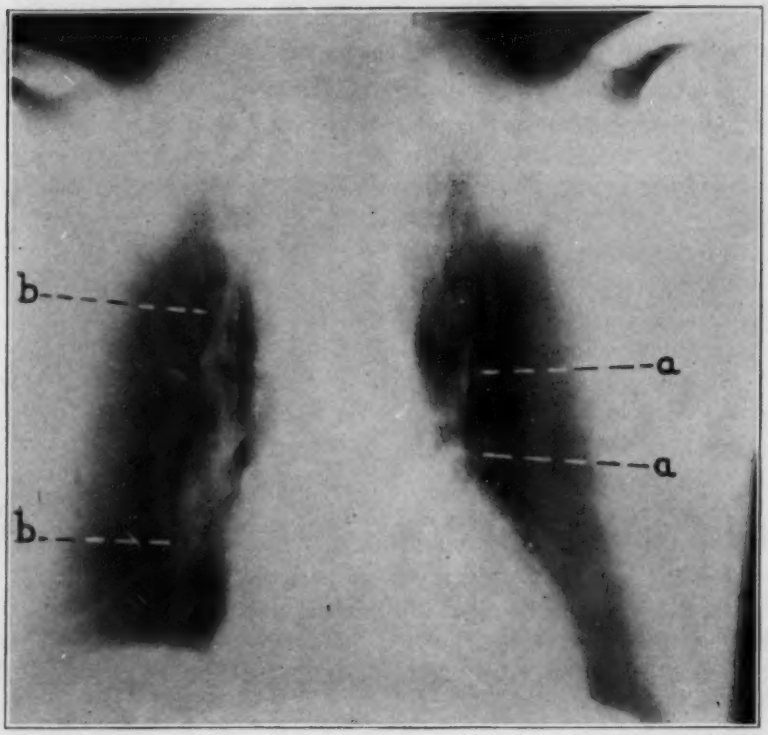

Fig. 3.—Body section roentgenogram of the chest. The larger bronchi are seen in the hili at *a*. Some of the vascular markings are seen in the lung fields at *b*.

roentgenograms of excellent detail made during the diastolic phase of the cardiac cycle.

It is appreciated that the foregoing discussion may be considered academic and of no practical importance so far as the distribution of the bronchi is concerned, because of the improved methods for delineating the bronchi after the instillation of an opaque medium and because of the increased use of the bronchoscope. Nevertheless, it is my firm belief that too many roentgenologists are misinterpreting normal variations of the vascular markings in terms of pathology.

THE BRONCHI

The first subdivision of the right bronchus is the right upper lobe bronchus (eparterial), which comes off at an angle of almost 90 degrees and passes above the pulmonary artery. This bronchus gives off a branch, the vertebral, which passes upward parallel to the spine to the apex of the lung and gives off branches which extend anteriorly and posteriorly. The upper lobe bronchus gives off another important branch, which is designated as the second interspace bronchus because it comes off behind the level of the second interspace in front. This bronchus likewise gives off anterior and posterior branches.

The portion of the right bronchus between points from which the upper and the middle lobe bronchi come off is termed the stem bronchus. Foreign bodies frequently lodge in this region.

The middle lobe bronchus comes off the stem bronchus anteriorly. It divides into many branches, but there are two main divisions as a rule: (*a*) the branch which passes downward and anteriorly and (*b*) the branch that passes upward and laterally.

The right lower lobe bronchus bifurcates into several main branches, which have been variously described as the anterior, middle and posterior division branches in the lower portion of the lower lobe and the apical branch in the upper portion. All of the main subdivisions give off many branches. Disease of the mesial and posterior division bronchi produces shadows that border on the shadow of the heart in dorsoventral roentgenograms. Further identification of the bronchi can be obtained from the oblique and lateral projections.

The left upper lobe bronchus (hyparterial) passes below the pulmonary artery. Its subdivisions are similar to those of the right except that there is a branch which goes to the lingual tip of the upper lobe, which is that portion in front of the heart.

The left lower lobe bronchus has a longer course than the right before it gives off any subdivisions. Otherwise it and its subdivisions are similar to those of the right lower lobe bronchus.

THE LUNG FIELDS

As the bronchial tree is followed to its ultimate divisions, there occurs a lack of the regular bronchial outline with the gradual appearance of an air passage whose walls are lined with variable, irregularly placed air spaces. These terminal air channels are called the respiratory bronchioles, which, in turn, divide into smaller branches, known as the alveolar ducts. These alveolar ducts are smaller than the respiratory bronchioles from which they spring and are lined by more alveoli than the aforementioned bronchioles.[3b,c] The alveolar ducts lead into from two to five spheroid cavities, called atria. The atria, in turn, open into numerous air sacs, around the periphery of which are situated the alveoli.

The bronchial musculature forms sphincters about the channels leading into the atria and around the alveoli which line the smaller bronchioles.[3d] These sphincters probably play an important role in the muscular spasm known to occur in asthma. Normally, air passes unimpeded by these sphincters. With muscle contraction, the air channels reduce in size, preventing the egress of air, which produces an increase in residual air with the formation of emphysematous lobules.

The structures described in the foregoing paragraphs comprise the anatomic unit, or primary lobule, of the lung, which may be defined as a ductulus alveolaris, the air spaces connected with it and all their associated vessels, nerves and lymphatics. The primary lobule has the form of a truncated pyramid, with its base directed toward the periphery of the lung.[3b,c] Its air passage (ductulus alveolaris) usually enters the primary lobule at the side rather than at its apex. Primary lobules vary in size from 0.45 mm. to 0.845 mm., the larger units situated in the peripheral and basilar portions of the lung. It is obvious that these lobules are not seen in a roentgenogram. It is only barely possible that one sees roentgenographically the larger, secondary lobules, which are made up of fifty to two hundred and fifty of these primary units.

EFFECT OF THE PHASES OF RESPIRATION ON THE ROENTGEN APPEARANCES IN THE CHEST

During inspiration, the first five ribs rotate up and out, carrying the sternum forward and upward. These movements increase the anteroposterior dimensions of the chest, thereby expanding the upper lobe of the lung in an anteroposterior direction and allowing an influx of air.[6a] The ribs maintain a constant relationship with the upper lobe in its anteroposterior excursions, with the result that impressions of the first five ribs may frequently be seen on the anterior surface of the upper lobe in postmortem specimens. Such markings, however, are unusual in the lower lobes. During inspiration, the lower lobes are allowed to expand by the descent of the powerful diaphragmatic muscles, which increase the depth of the chest, and by the action of the lower intercostal muscles, which increase the transverse diameter of the chest.[6a] These forces are much greater than those influencing the upper lobes. Because of this, the lower lobes are expanded downward during inspiration, thereby massaging the pleural surfaces against the long axis of the ribs, which explains the absence of rib markings such as those previously referred to as commonly found in the upper lobes. The summation of these inspiratory forces produces expansion in a forward, downward and outward direction, with considerably more expansion taking place in the lower lobes than in the upper.[6a] The trachea and its ramifications also feel the effects of these inspiratory forces as the trachea and the

hili move downward and forward, while the bronchial tree and the vascular structures become elongated.[6b,c] Keith[6a] has stated that when more is learned about normal respiration, the lobation of the lung and the great fissures will be found to be of functional significance.

Keith and Miller have expressed the belief that the bronchial tree spreads and elongates during inspiration. Macklin's [6b,c] work, while not conclusive, does not support the theory of spreading of the bronchi, although it does show the elongation very well.

Working against these inspiratory mechanisms are the heart, the vertebral column and the vertebral portions of the ribs. These portions of the chest are antagonists to pulmonary expansion by virtue of their anatomic characteristics.[6] Being relatively fixed structures, they cannot move to allow the nearby lung to expand (fig. 4).

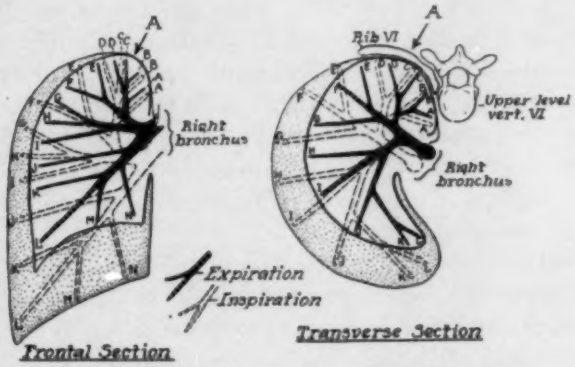

Fig. 4.—Diagram showing the differences in expansion in the various portions of the lung. Note the decreased expansion in the upper lobe and in the paravertebral gutta. Even this amount of expansion is decreased if disease occurs in these portions of the lung. (Modified from Macklin.[6c])

In like fashion, the apex of an upper lobe does not expand as fully as does the lower portion of an upper lobe, which is not inhibited by the peculiar conical shape of the upper thoracic cage. One concludes, therefore, that the amount of air entering the lower lung field and the periphery of the lung is greater than that which enters the upper lobes or the hili.

In concluding this discussion on healthy lungs, attention should again be directed to the importance of respiratory movements in the drainage of the lungs (intrabronchial and lymphatic). Fixation or limitation of lung movements by a disease process of either pulmonary or pleural tissues or of both will inhibit normal drainage.

BRONCHOGRAPHY IN BRONCHIECTASIS

It is not my purpose in this presentation to discuss the roentgen findings of the different types of bronchiectasis as they manifest themselves on the roentgenograms of a conventional roentgen examination of the chest, made on a subject in various positions. This has been done elsewhere. Furthermore, the information gleaned from such a study is not adequate. Bronchiectasis may be present and not show any evidence of its presence on the conventional roentgenogram. Likewise, when bronchiectasis can be diagnosed from the roentgenogram, it is impossible in most instances to tell the surgeon the extent of involvement. In order to supply the surgeon and the bronchologist with the information which they need in order to determine the type of treatment that should be employed, it is necessary to use bronchography. Before this procedure is carried out, it is our routine with every patient to make a roentgen examination of the neck, chest and esophagus. The examination of the esophagus is regarded as an integral part of this study, in order that one may diagnose or exclude any lesion in the esophagus that involves the adjacent mediastinal structures by direct invasion or any lesion, such as preventriculosis, that allows retained contents to be aspirated into the lungs from the filled esophagus. In a number of cases I have seen aspiration pneumonitis diagnosed as some other condition before the true cause was found.

Many technics are employed in bronchography. The technic that we employ might be called the bronchoscopic, or direct, method. This technic is adaptable to all types of bronchiectasis and is the only satisfactory one if there are large amounts of retained secretions.

In preparation, the patient is not permitted to take anything by mouth for six hours before the examination. One hour before the bronchoscopic examination, he is given a hypodermic injection of ¼ grain (0.015 Gm.) of a solution containing morphine sulfate.

After the anesthetization of the pharynx, the bronchoscopic examination is performed in the bronchoscopic operating room, during which time the trachea and the larger bronchi are anesthetized and the secretions aspirated. Immediately after the removal of the bronchoscope, a soft rubber catheter with a curved metal tip is passed into the nose, directed into the larynx and trachea and fixed in place. The patient is then taken into the fluoroscopic room, and an opaque medium is instilled during fluoroscopic examination. The preliminary aspiration allows the opaque medium to be instilled into any and all parts of the lung. During the fluoroscopic observation films are made by the "flash" technic with the subject in various anteroposterior, rotated and lateral positions and in various phases of respiration, in order to obtain a permanent record of the pertinent fluoroscopic observations.

These studies are carried out with the patient on a motor-driven tilt table. Such an apparatus facilitates greatly the study of a patient in various postures, especially in the inverted positions assumed for a study of the upper lobes of the lungs.

The study is carried out in an orderly manner. The metal tip of a catheter is manipulated into the part to be studied first. The desired location is assured by examining the patient in all directions. If a patient requires additional anesthesia, the anesthetic is instilled through the rubber catheter. We have found that the patient is less likely to cough if frequent aspirations are made of the saliva from the mouth. Instillation of the opaque oil is begun slowly. We use a 30 cc. syringe, which fits the catheter attachment as it protrudes from the nose. Slow instillation is exceedingly important, as it affords the best opportunity to make careful fluoroscopic studies during quiet and forced respiration. Likewise, one is less likely to overdistend localized areas of the pulmonary structures. Such an error in technic prevents one from obtaining any reliable information.

I prefer to study one lung at a time. It is easier on the patient, and the films are easier to interpret, because there are not so many confusing superimposed shadows. The other lung may be studied a few days later, after the major portion of the opaque oil has been coughed out. If it becomes necessary, one can study all of the lobes of both lungs at one sitting. For the study of one lung in a child, 10 cc. of opaque oil is usually required, for an adult 20 to 30 cc. is adequate.

After the fluoroscopic examination, the catheter is withdrawn, and conventional roentgenograms are made of the chest in predetermined positions. After this the patient is returned to bed and encouraged to cough and rid himself of as much of the contrast medium as possible. It is a common occurrence to find the opaque oil remaining in diseased portions of the lung for days and even months or years after a bronchographic study has been made. We feel, therefore, that follow-up films will give complementary information concerning the drainage of the lung.

My investigations during the procedure of bronchography are such that I hope to obtain information on the following points:

1. *Location and Extent of the Disease Process.*—Is the disease process in the upper, lower or middle lobe of the lung? Are multiple lobes involved? Is the process bilateral? The answer to these questions cannot always be given by the bronchologist. Unless the radiologist is able to determine the extent of the pulmonary involvement, the surgeon is at a loss to know whether an operation is indicated and how extensive the operation should be to rid the patient of the disease.

2. *Structure of the Bronchial Tree.*—Information about the structure of the bronchial tree can be obtained only after the instillation of opaque

material into the bronchi. One can demonstrate the presence or absence of normal variations (such as accessory bronchi coming off the lateral wall of the trachea and going directly into the upper lobe) and of abnormalities resulting from localized or generalized disease. Films made of the chest in various positions give the surgeon information of real importance concerning the major bronchi.

3. *Condition of the Flexible Elements.*—Are the flexible elements intact or are they destroyed? This question is probably the one of major importance, in that from the information derived from the studies made in the effort to answer it the clinician decides as to conservative or radical treatment. What studies should the radiologist make to answer this question?

The pathologic changes occurring in bronchiectasis may be summarized as follows:[10] There occurs a lymphocytic infiltration of all the layers of the bronchial wall; ulcerations develop in the mucosae; the flexbile elements (muscle, cartilage and elastic fibers) of the bronchial wall are destroyed; the normal columnar ciliated epithelium is changed to stratified squamous epithelium, and the elastic elements are replaced by fibrous elements.

The changes in the mucosae cause loss of the cough reflex. The pathologic changes produce loss of tone and stagnation of the infected secretions which results in the condition of dilated or tubular bronchi and saccular bronchioles filled with purulent material. The secretions cannot be coughed up until they overflow onto normal mucosa where the cough reflex can be initiated. In the presence of the aforementioned changes clinicians have come to the conclusion that the changes are irreversible (the flexible elements are destroyed) and that only removal of the involved lobes will effect a cure.[10]

Most of the indications for conservative treatment will be considered by others in this symposium, but there is one group of patients (those in whom the changes are reversible) who should receive special consideration here.

In order for the radiologist to judge that the flexible elements are intact, it is essential that the dynamics of the lung should be normal or in such a condition that with conservative measures one might expect the lung structures to return to a healthy state. The roentgen evidence that the flexible elements are intact is the change in the diameter and the length of the bronchi during respiration. At the end of inspiration, the bronchi increase in size and elongate; at the end of expiration, they decrease in size and become shortened, and they change in size and

10. Greenfield, J.: Bronchial Calibre Changes in Bronchiectasis, J. Clin. Investigation **19**:723-728, 1940.

length during coughing (figs. 4 and 5). The elongation and the shortening of the bronchi may be modified if the mediastinal structures are infected and fixed or if there is some thickening of the pleura along the lateral wall of the chest or in the interlobar fissures. Jarre [11] stated that the angle of the bronchi as these join the main stem may vary as much as 41 to 81 degrees. During active respiration, the action of the

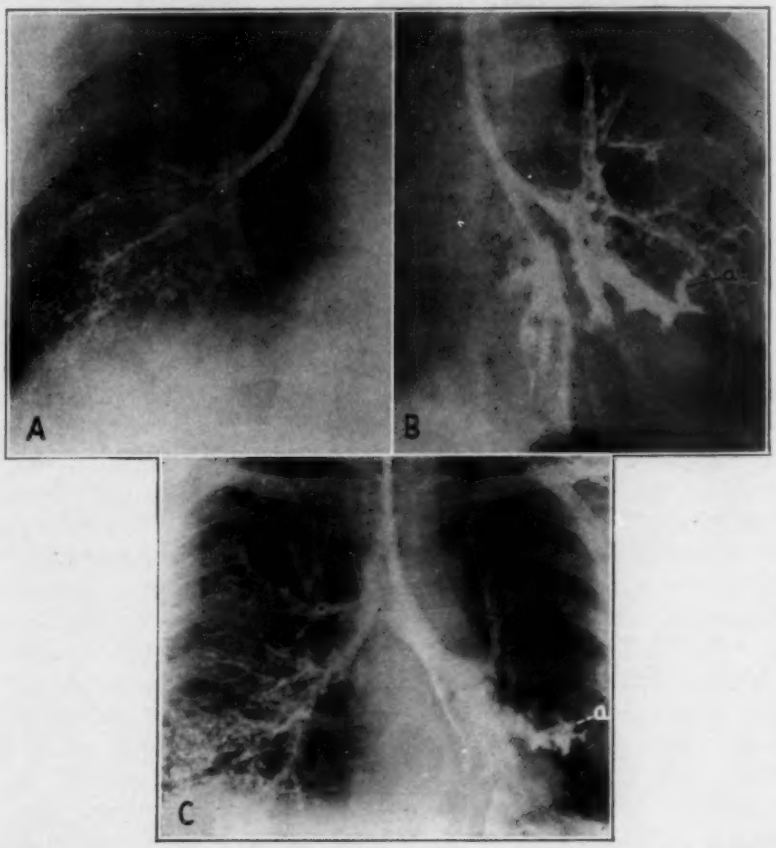

Fig. 5.—Bronchograms. *A*, the bronchus of the lower lobe of the right lung shortly after the instillation of iodized poppyseed oil. *B*, the bronchus of the lower lobe of the left lung. Note the pathologic changes in the bronchus at *a*. These changes are irreversible. *C*, the entire lung field, showing that the disease process is limited to the lower lobe of the left lung at *a*.

bronchi simulates the opening and closing of a fan. Unusual angulation caused by scar contraction interferes with drainage.

11. Jarre, H. A.: Roentgenologic Studies on Physiolgoic Motor Phenomena, Radiology **15**:377-394, 1930.

4. *Degree of Fixation.*—The conditions that lead to fixation of the lung include an intrapulmonary lesion, thickening of the pleura (especially interlobar) and mediastinitis. If the lung does not expand and contract well, normal drainage is interferred with.[12]

5. *Time Required for the Lung to Drain.*—A healthy lung may drain completely in four to eight hours. Some lungs may take twenty-four hours or longer. If a lung requires several days or months or a longer period to drain, one can regard the drainage as definitely abnormal.

In concluding this discussion, I add my plea to that of others that patients suspected of having bronchiectasis should be submitted to the procedure of bronchography early, with the hope that a comprehensive diagnosis will be made before the final picture of bronchiectasis is initiated. It may be that radiologists will learn to recognize the condition in an increasing number of instances before there is destruction of the muscle, cartilages and elastic fibers of the bronchial wall and when the disease process is reversible and therefore susceptible to conservative measures.

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12. Jacobaeus, H. C.; Selander, G., and Westermark, N.: Attempt at a Clinical Functional Test of the Emptying Capacity of the Bronchi, Acta med. Scandinav. **61**:380-437, 1929.

SURGICAL TREATMENT OF BRONCHIECTASIS

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The concept that bronchiectasis should be treated by a radical surgical procedure is by no means new. Starting during the later part of the nineteenth century there were sporadic attempts by a number of surgeons to excise the involved pulmonary lobe. Most of these attempts were unsuccessful, owing to difficulties in surgical technic. After these early efforts, the operation of lobectomy was largely abandoned because of the prohibitive surgical mortality.

Within the last ten or fifteen years thoracic surgeons and their physician-anesthetists have become better acquainted with the physiology of the cardiorespiratory system. A better understanding of the physiologic principles involved in this system and many improvements in surgical technic have reduced the mortality from the surgical treatment of bronchiectasis to a point comparable to that seen in the other branches of surgery.

Before embarking on an "all out" program of radical surgical treatment for bronchiectasis one should be convinced of several points: (1) that bronchiectasis is a disease which if left alone eventually carries a high mortality; (2) that bronchiectasis in the moderate or well advanced stage cannot be cured permanently by any conservative form of therapy, and (3) that radical surgical treatment offers a reasonable chance of complete and permanent cure.

It has long been the general impression that patients with bronchiectasis die young. It is true that many of these patients may go along for ten years or more, but eventually they succumb to the complications of the disease. Many observers have pointed out that there are few elderly people with bronchiectasis and that even these do not have the advanced form of the disease or have acquired the disease during adult life. Young persons with moderate or well advanced bronchiectasis usually die of some complication of the disease. They have recurrent bouts of pneumonia or pneumonitis. Not infrequently lung abscesses develop in these patients, with the high mortality associated with this complication. Occasionally a bronchiectatic cavity ruptures into the pleural space, producing an empyema with a bronchopleural fistula.

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Hence, it has generally been agreed that these patients come to an untimely end as the result of recurrent pulmonary suppuration.

Graham, Singer and Ballon [1] in their book on diseases of the chest, published in 1935, expressed agreement with these general impressions but admitted that they were able to find remarkably little in the way of statistical data in the literature. In 1940 Perry and King [2] published the results of a statistical study based on a follow-up investigation of 400 patients with bronchiectasis observed in the Massachusetts General Hospital, in Boston. Their data in large part confirmed the general impression which was already so widely held. They found that of the patients in whom bronchiectasis developed during the first decade of life only 9.4 per cent lived to the age of 40. Moreover, of a group of patients who were not submitted to surgical treatment, 26 per cent were dead in five years. Thus, in this group of patients, those operated on had an operative mortality of about 4 per cent, while those not operated on had a five year mortality of 26 per cent. Moreover, of this group not operated on, 75 per cent were considered operable when first examined but either refused surgical treatment or for some other reason were not operated on. It seems obvious, therefore, that there can no longer be any doubt that bronchiectasis is a disease which eventually carries a high mortality.

The previous papers in this symposium have dealt with the etiology and pathology of bronchiectasis. However, I should like to direct attention again to the pathologic process. The bronchial wall has been destroyed by infection. Epithelization occurs in time, but the musculature and elastic fibers of the bronchial wall do not regenerate. The bronchi therefore become dilated and saccular. In long-standing advanced bronchiectasis there is considerable destruction of pulmonary tissue. This is replaced by fibrous tissue. These pathologic changes are irreversible. There is no method by which this fibrous tissue can be replaced by normal pulmonary tissue or by which a well advanced bronchial dilatation may be corrected. To be sure, the condition of the patient may be greatly improved symptomatically by clearing up of the infection, but that does not remove the fundamental pathologic process. It may be stated, therefore, that the premise of the surgical treatment of bronchiectasis is that the pathologic process is an irreversible one, so that the disease may be completely and permanently cured only by the complete removal of that portion of the lung which is diseased. Perry and King had a large number of their patients return for a second

1. Graham, E. A.; Singer, J. J., and Ballon, H. C.: Surgical Diseases of the Chest, Philadelphia, Lea & Febiger, 1935.

2. Perry, K. M., and King, D. S.: Bronchiectasis: A Study of Prognosis Based on a Follow-Up of Four Hundred Patients, Am. Rev. Tuberc. **41**:531-548, 1940.

bronchogram from one to fifteen years after the original observation. In no instance did they observe that previously dilated bronchi had become normal.

If it is agreed that bronchiectasis is attended by an eventual high mortality if left alone and that it cannot be cured completely by any form of conservative therapy, then one has only to show that radical surgical treatment offers a reasonable chance for a permanent cure with a low operative mortality. I should like to mention a few of the factors which have made this possible.

SELECTION OF PATIENTS

A complete diagnosis is of the greatest importance in the selection of a bronchiectatic patient for surgical treatment. As nearly as possible one must know the exact extent of the disease. This information can be acquired only from a complete series of bronchograms. Repeated bronchoscopic observations are helpful in ascertaining the extent of an acute infection on the basis of the bronchial secretion. However, this does not always give one the correct diagnosis as to the extent of the bronchiectasis. If a bronchiectatic area is free of acute infection, there may be no abnormal secretion at the time of the bronchoscopic observation. On the other hand, there may be a spill of purulent secretion from a diseased lobe into a lobe free of bronchiectasis. It is imperative, therefore, that a complete series of bronchograms be made to determine the exact extent of the disease. It is obvious that if a patient has bronchiectasis of the left lower lobe and of the lingula of the left upper lobe, he will not be cured completely by the removal of only the left lower lobe. In such a situation the patient's condition will be improved only in proportion to the amount of the total bronchiectatic area which has been removed.

The selection of a bronchiectatic patient for surgical treatment should be made only after careful study of the patient and evaluation of the results. The most acceptable patient for surgical treatment is the patient with bronchiectasis of only one lobe. Such a patient may be cured completely by lobectomy. If more than one lobe is involved, it is preferable that the disease be confined to one side, for a total pneumonectomy is a simpler procedure than a bilateral operation in stages. Not infrequently, however, the disease is bilateral, although it may be much more extensive on one side. This condition may be improved greatly even though not cured completely, by the removal of the involved tissue on the more severely diseased side. The patient with bilateral involvement is of necessity a much poorer surgical risk. A number of such patients have recovered, however, after the removal of bilateral bronchiectatic

areas in stages. Graham has a patient from whom he successfully removed the lower and the middle lobe of the right lung, the lower lobe of the left lung and the lingula of the upper lobe of that lung. It is obvious, however, that the surgical mortality is higher in patients with bilateral involvement.

PREOPERATIVE PREPARATION

If the surgical mortality is to be kept at a minimum, the patient must be rendered as free of acute infection as possible before operation. This must be done by the usual methods of conservative therapy. Postural drainage, bronchoscopic aspiration, the use of vaccines, treatment by sulfanilamide and its derivatives and the clearing up of associated sinal infections are all helpful. These procedures may alleviate the patient's symptoms greatly by reducing the amount of acute infection present and thereby reducing the amount of purulent expectoration. Occasionally a patient may be freed almost entirely of purulent secretion. Such a patient is the best operative risk. In this respect the bronchoscopist is of the greatest assistance to the surgeon. He not only plays an important part in clearing up the acute infection but makes direct observations as to the extent of the inflammatory process. My associates and I are interested not so much in the total amount of sputum as in where the sputum is coming from. A patient may have bronchial dilatation only in the lower lobe of the left lung but, on account of a spill over of pus to the other side, may have considerable acute inflammation and secretion in the lower lobe of the right lung. The bronchoscopist alone can tell when that acute reaction has subsided. When the purulent secretion is confined to the area of the bronchial tree which is to be removed, the patient is ready for operation. But if the patient is operated on during a period when he will have purulent secretion coming from the untreated side during the postoperative period, his convalescence will be much more stormy. Because of the pain in the incision during the immediate postoperative period, the patient may have great difficulty in coughing up the secretion, with resulting bronchial obstruction, atelectasis, pneumonitis and serious pulmonary suppuration.

When the patient's preoperative condition can be made ideal, the operative procedure is usually simplified and the postoperative course is smooth. When the patient's condition cannot be made ideal, as is always true if the bronchiectasis is bilateral, the postoperative complications and consequently the mortality will be increased.

A young patient is definitely the best surgical risk. Children stand lobectomy very well, while the ability of a patient to withstand such treatment certainly decreases rapidly after the age of 40. The vast

majority of the patients operated on are below this age. If it should become necessary to operate on a patient of 40 or more, it would be doubly important to have that patient in the best possible condition preoperatively.

OPERATIVE TECHNIC

I take it for granted that the members of this society are not especially interested in the operative technic, but perhaps it would be well to point out certain principles which have made the difference between the high operative mortality of thirty years ago and the low mortality of today.

Sauerbruch was a master surgeon, and yet the mortality he reported for lobectomy in 1929 was 34 per cent. At that time, when the chest was opened the surgeon was faced immediately with a race against death from anoxemia. Because the pneumothorax was open, the patient had inadequate respiratory exchange. It was a question of whether the surgeon could get the lobe out and the chest closed before the patient died of anoxia. Today, by means of intratracheal anesthesia, the patient is assured of adequate oxygenation, so that the surgeon may proceed with the operation in an unhurried manner over a period of several hours if need be.

The patient with bronchiectasis may be accustomed to coughing up 300 to 400 cc. of pus a day. If he undergoes the operation with a large quantity of pus in the diseased pulmonary lobe, this will almost certainly spill over into his bronchial tree during the operative manipulation of the lobe. The patient is then apt to drown in his own secretions, or bronchial obstruction with atelectasis and pneumonitis develops in the early postoperative period. Today the danger of such a complication is reduced to a minimum by clearing up the infection as much as possible before operation. In addition, however, a bronchoscopic aspiration is done immediately before the operation, to empty the bronchi as much as possible. Moreover, the intratracheal catheter offers a means of aspirating any mucopurulent material that may be expressed into the trachea at operation. If this proves to be unsatisfactory, the patient may be subjected to bronchoscopic aspiration before he leaves the operating table.

In the early days of lobectomy the hilus of the lobe was secured by a mass ligature. This left a body of infected tissue, which had to slough away. Consequently, many patients died of infection. Today, by reducing the infection to a minimum before operation it is possible to use a nicer surgical technic in removing the lobe. The ligation of the individual hilar structures is certainly the most logical procedure and has proved to be most satisfactory. When this method is not practical, the multiple suture method is used.

In the past, a bronchial fistula in the absence of external drainage accounted for a considerable part of the mortality associated with lobectomy. Now, the chest is drained with a large rubber tube to which is applied a negative pressure of 5 to 10 cm. of water. This maintains a negative pressure in the pleural space and thus keeps the remaining lobe of the lung distended. Frequently, a bronchial fistula occurs late, after the remaining lobe has become adherent to the parietal pleura. It is adequately taken care of by the drainage tube, and it usually closes rapidly. If a bronchial fistula occurs before the remaining lobe of the lung becomes adherent to the parietal pleura, that lobe may collapse and require several weeks or months to reexpand.

The postoperative nursing of a patient who has undergone lobectomy is of the greatest importance. If the patient has some bronchial secretion, he may be unable to cough it up because of the pain in his incision. If morphine is given, his cough reflex may be depressed to a dangerous level. If morphine is not given, his pain will be too severe to allow coughing. Thus, it is frequently necessary to take the middle course with the greatest of care. We have prevented this postoperative pain in some patients by cutting the intercostal nerves at the time of operation. In others we have blocked the intercostal nerve when the pain became too severe. If, in spite of the greatest care, the patient has secretion in his bronchial tree which he cannot cough up, we do not hesitate to have this removed by means of a bronchoscope even during the first few days after operation. A nerve block performed before the bronchoscopic procedure will be greatly appreciated by the patient.

It is our practice to administer oxygen through a nasal catheter routinely after operation. This is helpful, since the respiratory exchange is apt to be decreased by pain in the chest, but it favors the development of atelectasis. Therefore, one should insist on deep-breathing exercises at definite intervals.

MORTALITY

The mortality from radical surgical treatment of bronchiectasis has now been reduced to a figure comparable to that observed with other types of major surgical operation. When the disease is unilateral and the patient can be freed of his superimposed acute infection, the mortality should be nil—except for an occasional surgical accident, which may happen in any type of major surgical procedure. In cases in which the disease is bilateral, a considerably higher mortality is to be expected.

We [3] have operated on 12 patients for bronchiectasis. It so happened that 6 of these required total pneumonectomy, and 6 required lobectomy.

3. Two of the patients were operated on by Dr. I. S. Ravdin.

There have been no deaths. This is not an unexpected experience, considering that the series is small and that unusual attention to detail was exercised in the preparation and postoperative care of these patients.

It is obvious that the mortality associated with radical surgical treatment of bronchiectasis cannot be maintained at zero. However, it is our belief that it can be maintained very close to that among patients with unilateral disease. Tudor Edwards has reported 54 consecutive lobectomies without a death and has performed 166 lobectomies, with a mortality of only 3.7 per cent. Churchill now has a series of 122 lobectomies for bronchiectasis, both unilateral and bilateral, with a mortality of only 3.3 per cent. Certainly, as long as the mortality from lobectomy for bronchiectasis can be kept as low as 10 per cent, it is no longer a major objection to the surgical treatment of the disease.

RESULTS

If the entire bronchiectatic area is removed at operation, the patient will be cured completely. If, on the other hand, a residual area of

Bronchiectasis

	Patients	Cured	Improved
Total pneumonectomy.....	6	4	2
Lobectomy.....	6	5	1
Total.....	12	9	3

bronchiectasis is left behind, the patient will not be cured completely, but his condition will be improved in proportion to the amount of the diseased lung removed at operation. This again shows the importance of a complete diagnosis before operation.

Of the 12 patients operated on by us, 9 had unilateral bronchiectasis. All of these are apparently completely cured. They no longer have any cough or sputum. They are all in excellent health and are living a normal life. Of the 3 patients with bilateral bronchiectasis, all have been greatly improved, since the disease was much more extensive on the side which was operated on. Two of these patients had total pneumonectomy but still have some sputum from the bronchiectasis on the other side. The third patient had the lower lobe of the left lung excised and has been greatly improved. She is awaiting removal of the lower lobe of the right lung at a later date. In the follow-up examination of the patients operated on by Churchill, Perry and King found 67 per cent to be entirely well.

CONCLUSIONS

1. Bronchiectasis is a disease which carries a high mortality over a period of years if untreated or inadequately treated.

2. The pathologic process in bronchiectasis is irreversible, so that the disease may be cured permanently only by the surgical removal of that portion of the lung which is diseased.

3. Radical surgical procedure offers an excellent chance of complete cure with a minimum mortality in patients with unilateral bronchiectasis. In patients with bilateral bronchiectasis the risk is increased and the chances of a complete cure are decreased but even so the condition of many of these patients may be greatly improved and a few of the patients may be completely cured.

BRONCHOSCOPIC ASPECTS OF BRONCHIECTASIS

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PHILADELPHIA

There is much yet to be learned about bronchiectasis, and bronchoscopic examination is not the least important of the methods for investigation and study of this disease. The direct inspection of the diseased tissues and the observation of the effect of the disease process on the normal function of the bronchi have added much to the knowledge of the etiology, pathology, diagnosis, treatment, prevention and cure of bronchiectasis. I should like to repeat "cure" of bronchiectasis, because it is my belief that in many cases proper medical care with bronchoscopic aid will arrest the development of the disease in the early stages, while the process is still reversible. The facts that bronchiectasis develops slowly, that gradual dilatation of the bronchi occurs as the infection progresses and that the obstructing secretions, together with the expulsive efforts necessary to rid the bronchi of them, are important factors in the dilatation and in the progress of the infection make the endobronchial approach to the further study of bronchiectasis of great importance.

The part played by obstruction in the development of bronchiectasis was not fully appreciated until it was demonstrated by bronchologic observation. It is now a well known fact that bronchiectasis results from bronchial obstruction due to the long sojourn of a foreign body, with its complicating infections. The same mechanism is produced by an obstructing bronchial tumor, either benign or malignant. It has been demonstrated also that bronchiectasis has not occurred in cases in which the obstruction has been removed before infection and inflammatory changes have progressed to such an extent as to weaken the bronchial wall.

ETIOLOGY AND PREVENTION OF BRONCHIECTASIS

Bronchial Obstruction.—It has been emphasized by the other speakers in this symposium that bronchiectasis is frequently a sequela or complication of the pulmonary phase of an acute infectious disease of childhood. I should like to add a bronchologic observation on the

Presented at the Sixty-Third Annual Meeting of the American Laryngological Association, Atlantic City, N. J., May 28, 1941, as part of a symposium on bronchiectasis.

causation of bronchiectasis in childhood diseases that I believe is important: "The expulsive effort of the cough mechanism is much more feeble in infants and young children than in adolescents and adults." The retention of obstructive secretions is favored by this feebleness of effort, and when the effort is obtunded or suppressed entirely by the toxicity of the general infection or by the administration of sedatives a condition results which is ideal for, and in many cases undoubtedly is the cause of, atelectasis and bronchiectasis in young children. It is on this basis that I advocate bronchoscopic treatment of children with these conditions. The results of aspiration and drainage in such patients are remarkable.

A great deal of the value of the bronchoscopic treatment is the production of cough by the introduction of the bronchoscope. A peculiar coughing effort is produced, which I previously described as "selective cough." Not infrequently one sees plugs of mucus projected from the larger bronchi into the lumen of the main bronchus, in plain view of the bronchoscope, by coughing efforts. The bronchoscope pipes air down into this portion of the lung, so that the little patient has no difficulty in getting the air in. Then the expulsive effort occurs, and the obstructing secretion is expelled. Aspiration removes the secretion entirely from the lung, and ventilation and drainage are secured before bronchiectasis develops.

To the bronchoscopist there are two other important considerations in the bronchoscopic treatment of infants and young children. The first is the use of the "infant" bronchoscope, so that undue trauma is not inflicted. The second is the use of the technic perfected by Chevalier Jackson, in which the bronchoscopic procedure is carried out without the administration of anesthesia, either general or local.

Bronchologic observations have led me to conclude that in the great majority of cases bronchiectasis is an acquired condition. Congenital bronchiectasis has been greatly overemphasized. In the cases of some infants the diagnosis should be drowned lung or unresolved pneumonia and not congenital bronchiectasis. If the importance of the etiologic role played by obstructive secretions in the development of bronchiectasis were fully appreciated by pediatricians and if proper ventilation and drainage of the lung were secured by bronchoscope treatment, many of the cases of so-called congenital bronchiectasis would be prevented.

Unresolved Pneumonia and Drowned Lung.—The failure of the lung to rid itself of the products of unresolved pneumonia frequently results in bronchiectasis. In cases of this kind bronchial obstruction by inspissated secretion is not infrequently found on bronchoscopic examination.

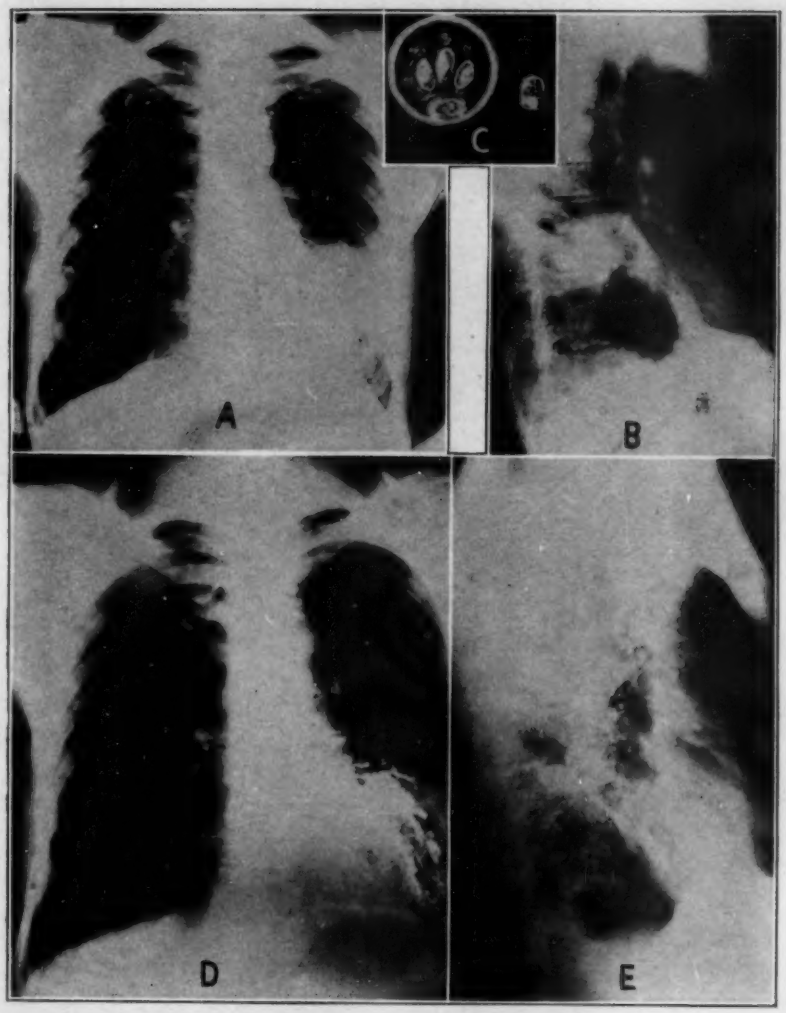

Fig. 1.—Prevention of bronchiectasis by bronchoscopic treatment in a case of unresolved pneumonia with a plug of inspissated secretion blocking the branch bronchus. Roentgen examination of a man 24 years of age six weeks after the onset of lobar pneumonia showed unresolved pneumonia (*A* and *B*). Bronchoscopic examination revealed an endogenous foreign body, inspissated secretion (*C* [inset]), blocking the posterior division of the bronchus of the left lower lobe bronchus. After removal of the inspissated secretion and aspiration, iodized poppyseed oil was injected bronchoscopically into the branch bronchus, demonstrating a bronchiectatic area (*D*). With repeated bronchoscopic treatment the lung cleared completely at the end of one month (*E*). The patient was discharged well. After fifteen years the lung showed no evidence of bronchiectasis.

The "selective cough" produced by bronchoscopic aspiration in unresolved pneumonia will frequently rid the lung of the obstruction, and if aspiration is carried out before the bronchial wall is weakened bronchiectasis will not result. Remarkable results have been observed in cases of this kind (figs. 1 and 2).

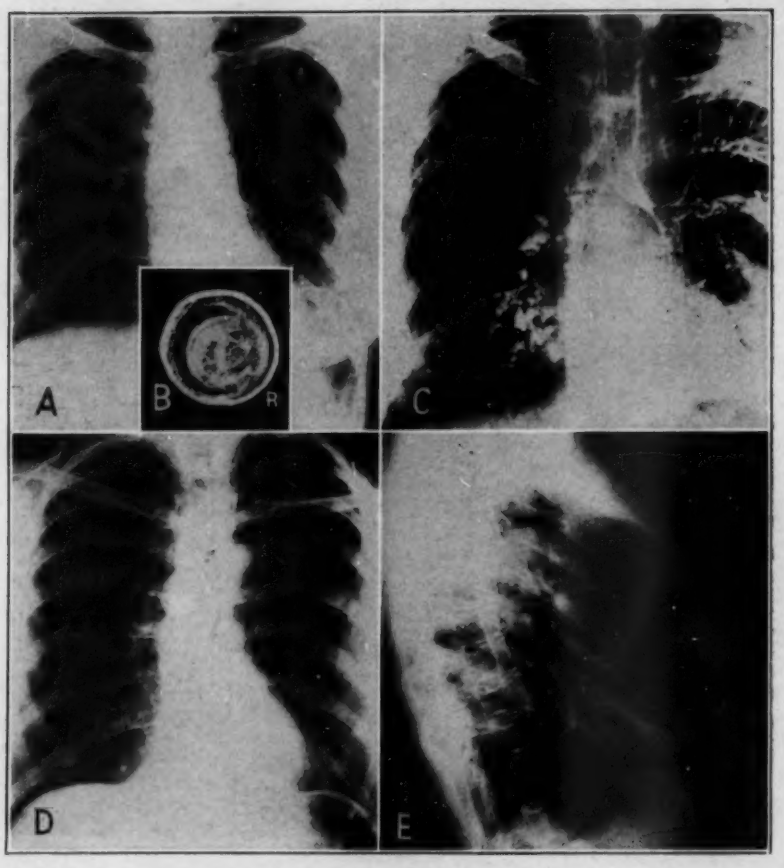

Fig. 2.—Prevention of bronchiectasis by bronchoscopic treatment in a case of bronchial compression and ulceration from infection of a mediastinal gland. Pulmonary infection developed in a woman 47 years of age. The diagnosis made after roentgen examination (*A*) was bronchiectasis of the lower lobe of the left lung. The insert (*B*) shows the bronchoscopic appearance of the main bronchus of the left lung. Ulceration resulted from compression of the peribronchial gland. A pneumonogram (*C*) made after insufflation of a bismuth compound shows stenosis of the left main bronchus and dilatation of the upper and lower lobe bronchi. Bronchoscopic treatment restored the crescentic lumen, as seen in *B*, to a functionally normal size. Histologic examination of the tissues showed inflamed glandular structure with no evidence of neoplasm. The patient remained well. Roentgenograms *D* and *E*, made sixteen years after the condition was cured by bronchoscopic treatment, showed no evidence of bronchiectasis.

In contrast to this condition, drowned lung results from the retention of secretion beyond a bronchial obstruction. The secretions are infective, and if the bronchial obstruction continues suppurative pneumonitis with bronchiectasis or bronchiectatic abscesses usually result. In most cases obstruction by a foreign body produces typical drowned lung (fig. 2).

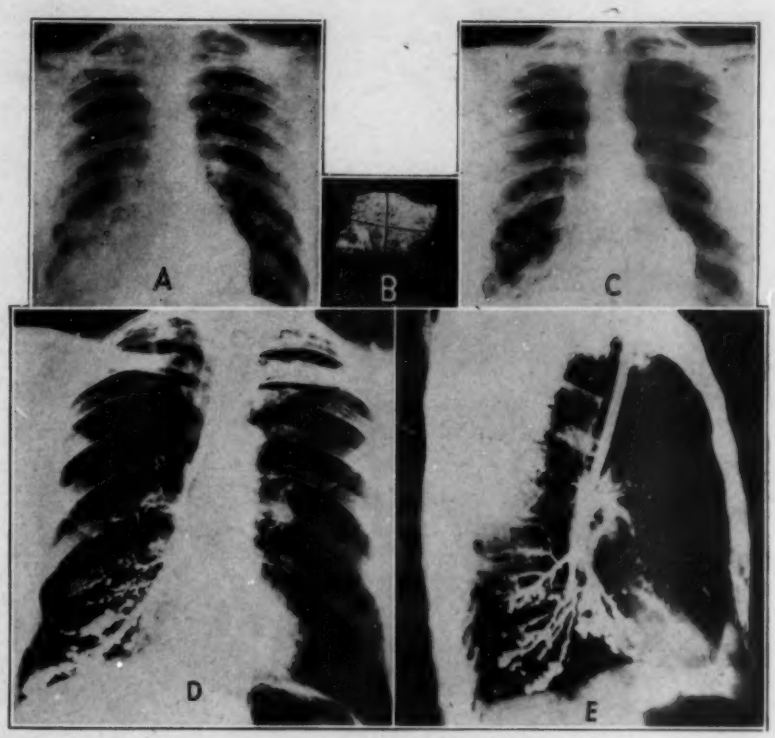

Fig. 3.—Bronchiectasis due to the presence of a foreign body. Pulmonary infection, found to be due to the presence of a foreign body (a fragment of soup bone) which had been aspirated six years before, developed in a man 41 years of age. The accident had been overlooked. Roentgen examination showed a diseased area in the lower lobe of the right lung (*A*). The bone (*B*) was removed by means of the bronchoscope. The diseased area of the lung (*C*) showed bronchial stenosis with infection and fibrosis, and bronchiectasis. The infection cleared, and the stenosis was completely relieved by bronchoscopic treatment. Instillation of iodized poppyseed oil eleven years after the removal of the foreign body showed that bronchiectasis was still present (*D* and *E*). Intermittently the fibrosed area of the lung shows purulent secretion.

In cases in which the foreign body is of recent sojourn, the removal of the foreign body allows drainage of the drowned lung before the infection spreads beyond the bronchi, and if drainage is maintained by bronchoscopic aspiration the lung will clear and bronchiectasis will not result.

Foreign Bodies.—Bronchiectasis caused by the presence of a foreign body is limited to the area obstructed by the object. There are usually definite pathologic changes in the bronchus, and a cicatricial stenosis frequently develops at the point of sojourn of the foreign body. However, a stay of weeks, months or years is usually required to produce a permanent change. If cicatricial stricture develops, the stenosis may be successfully dilated through a bronchoscope (fig. 3). Prompt removal of a foreign body of recent sojourn usually allows the lung to drain even without bronchoscopic aspiration. In the early days of bronchoscopy this led to the rule, "After the removal of a foreign body, further bronchoscopy is not necessary." Experience has proved that this is incorrect. Even a recently inspirated foreign body, particularly a peanut or an organic substance, may produce atelectasis and serious infection in the lung. Unless there is some contraindication, such as an obstructive edema of the larynx, which makes it inadvisable to reinsert the bronchoscope, aspiration should be done in every case after the removal of a foreign body. When the sojourn of the foreign body has been long, it is important that bronchoscopic aspiration be carried out repeatedly after the foreign body is removed, in order to insure adequate drainage.

The prognosis for cure of the infection with bronchoscopic drainage is much better with bronchiectasis following the inspiration of a foreign body than with bronchiectasis following an inflammatory lesion. The probable reason is that in the former condition the infection originates in the bronchi rather than in the parenchyma of the lung, as in postpneumonic bronchiectasis.

BRONCHOSCOPY IN DIAGNOSIS AND TREATMENT

The bronchologist, then, is properly called on to prevent, treat and cure bronchiectasis in an early stage (cases 1, 2 and 3 [figs. 10, 11 and 12]) to aid in diagnostic studies, to assist the surgeon when surgical intervention is required and to follow the surgical treatment by bronchoscopic observation until the patient is free of pulmonary infection.

Aid in Pneumonography.—Bronchoscopic examination is an aid in mapping of the lungs for pneumonography. In practically every case it is advisable to make a diagnostic bronchoscopic examination before a pneumonogram is made, even when this is done with fluoroscopic guidance, in order to know the exact distribution of the bronchi and whether or not abnormalities are present. Bronchoscopy and pneumonography are complementary procedures. Both are of great importance and are necessary for accurate diagnosis when the presence of bronchiectasis is suspected (figs. 4 and 5).

Diagnostic Bronchoscopy with Catheter Pneumonography: A diagnostic bronchoscopic examination is made of the entire tracheobronchial tree, including the retrograde telescopic inspection of the upper lobe bronchi. The openings of the branch bronchi are clearly visualized, and their positions in relation to the normal distribution are carefully noted. Deviations, dilatations and stenoses are considered and their locations

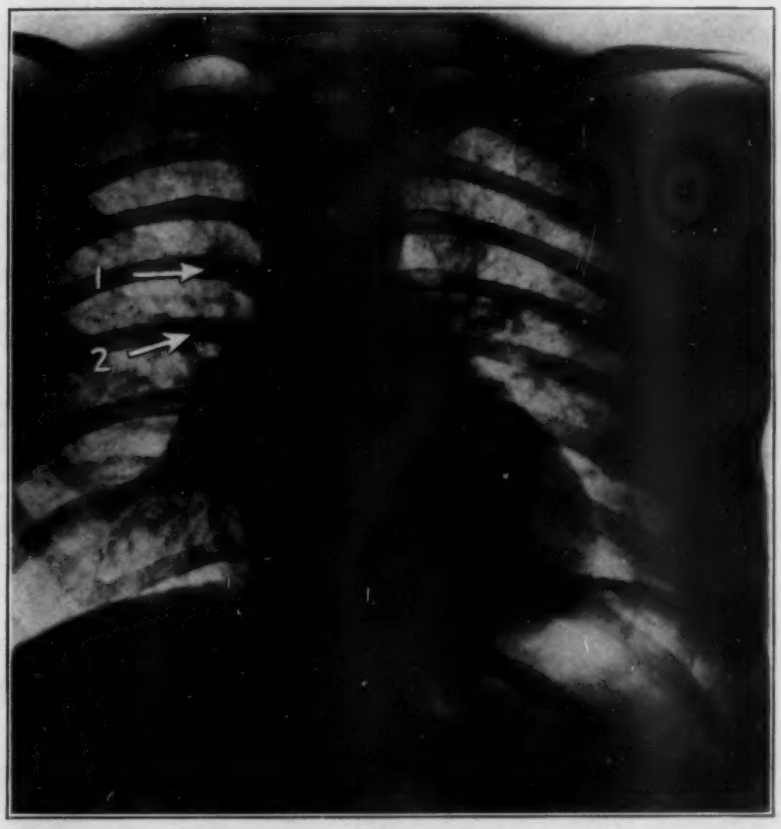

Fig. 4 (bronchoscopic aid in pneumonography).—Anomaly of the tracheobronchial tree. The branch in the upper lobe of the right lung arose above the carina. Bronchoscopic examination revealed that the opening of a branch bronchus was abnormally placed. Insufflation of a bismuth compound demonstrated this roentgenographically. If an opaque medium is instilled by means of a catheter, accurate introduction of the material is facilitated by previous knowledge of the distribution and abnormalities of the tracheobronchial tree as revealed by bronchoscopic examination.

recorded. In adults the tracheobronchial tree is well anesthetized with a 4 per cent solution of cocaine hydrochloride in an atomized spray,

and a 10 per cent solution of cocaine hydrochloride is applied with a swab in the region of the carina and larynx; a 2 per cent solution of cocaine hydrochloride is also applied in the nose on the side in which there is a free airway for the passage of the catheter. A 2 per cent solution of pontocaine hydrochloride is used for children. The broncho-

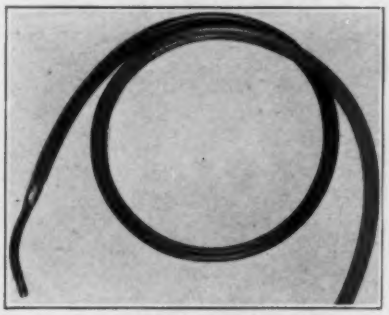

Fig. 5.—The author's tube for the instillation of iodized poppyseed oil.

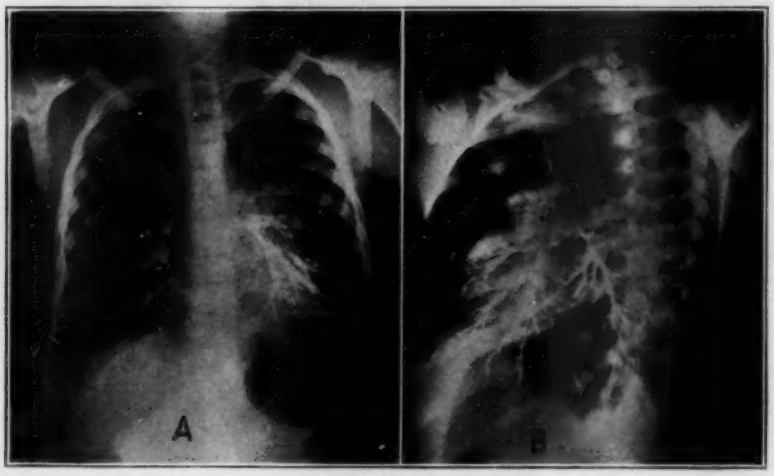

Fig. 6 (bronchoscopic aid to the surgeon).—Catheter pneumograms made after a diagnostic bronchoscopic examination.

A child 5 years of age had chronic pulmonary disease involving the lower part of the left lung. A diagnostic bronchoscopic examination showed involvement of the lower lobe of the left lung only. Catheter pneumonograms made by Dr. Joseph P. Atkins (films by Dr. Arthur Finkelstein) confirmed the bronchoscopic evidence.

Examinations such as these demonstrate clearly to the surgeon the portion of lung to be excised.

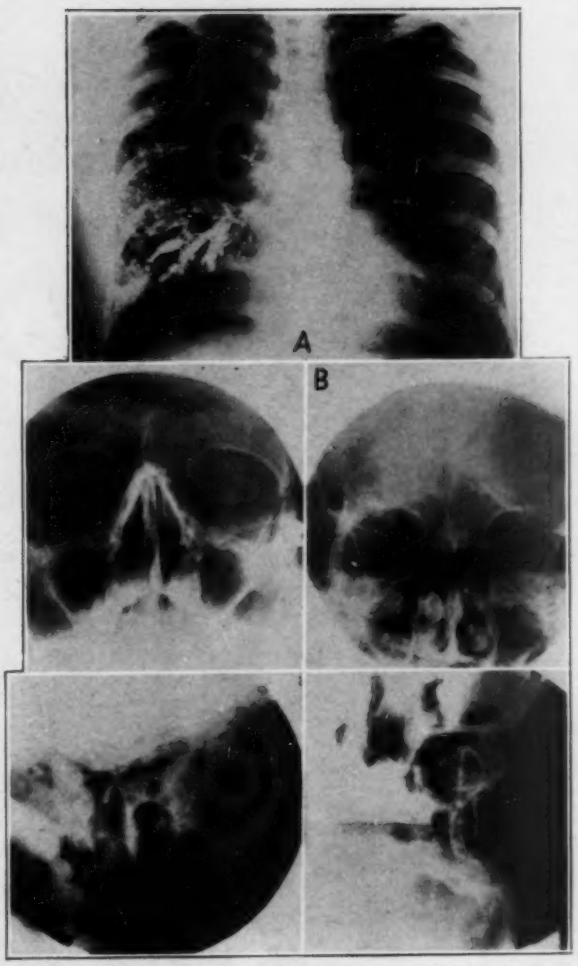

Fig. 7 (bronchoscopic aid in pneumonography).—Localized bronchiectasis without symptomatic or roentgen evidence of sinus disease.

A woman 37 years of age with a history of productive cough for fifteen years had repeated examinations of the sinuses, which gave no evidence of disease (*B*). An extensive localization lesion in the middle lobe of the right lung (*A*) was demonstrated by bronchoscopic examination and the instillation of iodized poppy-seed oil. The condition responded well to bronchoscopic drainage, postural drainage and the administration of autogenous vaccine. The case demonstrates the occurrence of extensive bronchial disease without sinusitis.

If sinus disease is present, adequate treatment should be given; organic disease of the lungs should be treated bronchoscopically and should not be overlooked because the sinuses are clear.

scope is removed and the tube devised by me for the instillation of iodized poppyseed oil (fig. 5), which is provided with a curved flexible metal tip for clear visualization and ease of introduction into the branch bronchi

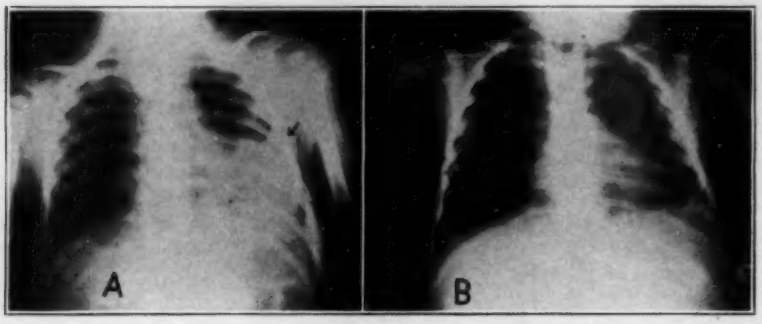

Fig. 8 (prevention of bronchiectasis by bronchoscopic treatment).—In a child 1½ years old a drowned lung complicated an infection of the upper respiratory tract. He had acute mastoiditis requiring operation. After mastoidectomy his temperature remained elevated, though the mastoidectomy wound was clean. After one bronchoscopic aspiration the drowned lung cleared completely. The child's temperature became normal, and he recovered completely. *A* is a roentgenogram of the chest before bronchoscopic aspiration of the obstructing secretion. *B* shows the lung clear after bronchoscopic treatment.

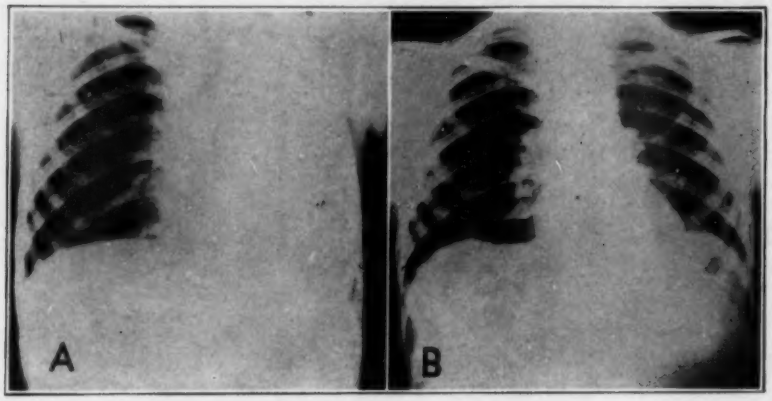

Fig. 9 (prevention of bronchiectasis by bronchoscopic treatment).—Unresolved pneumonia.

Lobar pneumonia involving the entire left lung (*A*) developed in a boy 11 years of age. Signs persisted to the twenty-fifth day of the disease. After bronchoscopic treatment the temperature became normal. A second bronchoscopic treatment was given four days later. The temperature remained normal. A follow-up roentgenogram (*B*) made three months after the condition was cured showed no evidence of bronchiectasis or residual infection.

under fluoroscopic guidance, is then introduced into the previously anesthetized airway through the nose and nasopharynx. Direct laryngoscopic guidance is used for the introduction of the metal tip of the tube into the larynx and trachea. The tube is then passed downward to about the level of the bifurcation, and the catheter is fastened with adhesive tape to the tip of the nose, to prevent its being dislodged. The patient is removed to the roentgenologic department for fluoroscopic guidance during the introduction of the opaque oil into the desired area of the tracheobronchial tree. The use of Dr. Pendergrass' spot film technic during the introduction gives invaluable information, which becomes a permanent record, before the iodized poppyseed oil gets into the parenchyma. Other views, anteroposterior, lateral, oblique and

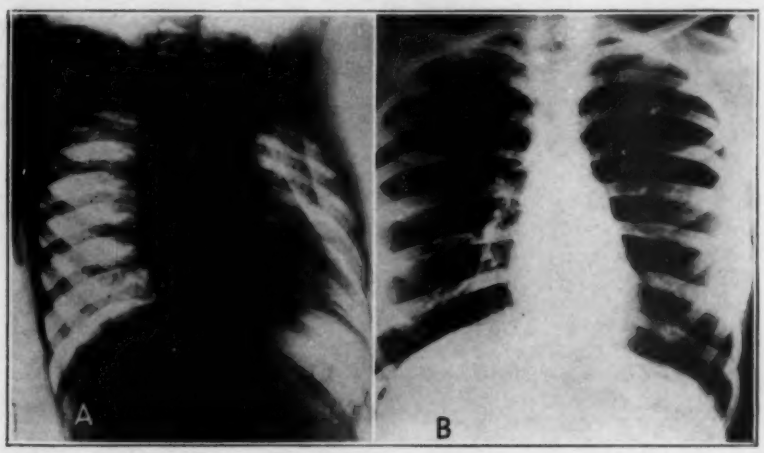

Fig. 10 (case 1).—Postpneumonic atelectasis with bronchiectasis of the left lung.

A girl aged 12 years, a patient of Dr. H. W. Brayton, of Hartford, Conn., had pneumonitis with bronchiectasis after an attack of pneumonia. A diagnostic bronchoscopic examination and pneumonograms showed the bronchiectatic area to involve the lower lobe of the left lung (*A* [by Dr. Eugene Pendergrass]). Repeated bronchoscopic drainage with postural drainage and the use of autogenous vaccine resulted in cure at the end of six months. A follow-up film (*B*) by Dr. D. J. Roberts, of Hartford, Conn., showed the lung to be clear two and one-half years later.

with the head raised or lowered, as the roentgenologist may direct, are made, to demonstrate disease or normality.

This technic, as devised by Dr. Eugene Pendergrass, of the Hospital of the University of Pennsylvania, has marked the greatest improvement in bronchography yet made.

Aid to the Surgeon.—Patients with bronchiectasis in an advanced stage should be examined bronchoscopically, to find the exact location and extent to which the lobes of the lung are involved. This should be followed by pneumonography, to determine, if possible, the involvement of the various pulmonary segments (fig. 6). Postural drainage and bronchoscopic removal of granulations and obstructive tissues will in many cases help to localize the lesion so that surgical treatment can be accomplished; or in certain cases the surgical procedure may be less radical, with clearing up of the less involved areas under this regimen plus autogenous vaccine therapy.

In cases of extensive bronchiectasis, bronchoscopic treatment alone is only palliative. It has, however, the virtue of reducing the sapro-

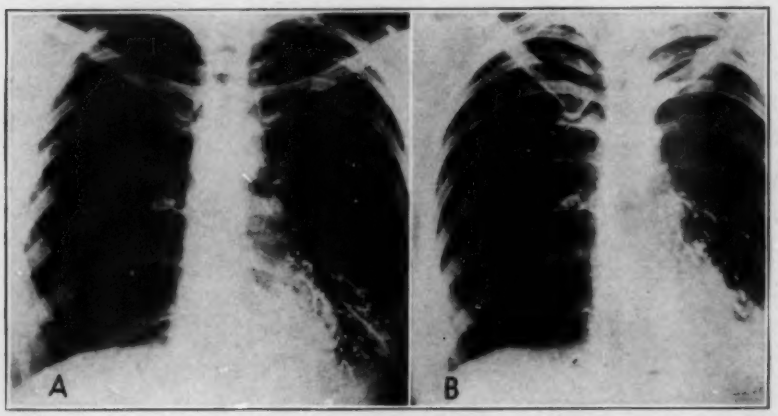

Fig. 11 (case 2).—Postpneumonic atelectasis with bronchiectasis of the left lung.

A girl aged 19 years, a patient of Dr. Simon Leopold, had a suppurating area with bronchiectasis in the lower lobe of the left lung following an attack of pneumonia. Bronchoscopic examination confirmed Dr. Leopold's diagnosis. A roentgenogram (*A*), made after iodized poppyseed oil was introduced, confirmed the bronchoscopic observations. After repeated bronchoscopic treatments with postural drainage and medical care by Dr. Leopold, the lung cleared completely. A follow-up bronchoscopic and physical examination gave no evidence of disease in the lower lobe of the left lung. A pneumonogram (*B*) made after the introduction of iodized poppyseed oil showed the bronchi to be normal two and one-half years after the onset of the bronchiectasis (films by Dr. Eugene Pendergrass).

phytic infection and removing the obstructive granulation, and frequently it gives the patient great comfort. In cases of localized bronchiectasis with no roentgen evidence of sinus disease, bronchoscopic treatment may effect a cure without external surgical treatment. In

the past many patients who were inoperable reported regularly to the various bronchoscopic clinics. In some cases they refused surgical treatment because they felt so well. However, with the development of the technic of lobectomy and of pneumonectomy to a point where the mortality is very low, every effort is made to persuade patients such as these to have surgical treatment.

Chemotherapy for Bronchiectasis.—Efforts have been made to treat bronchiectasis with various chemotherapeutic agents administered intrabronchially. The great difficulty has been that the drugs introduced into the bronchiectatic areas injured the lung more than they did the pathogenic bacteria. With the development of sulfanilamide and its derivatives, however, there is hope that a medicament may be found which is effective and safe for bronchoscopic insufflation. The applica-

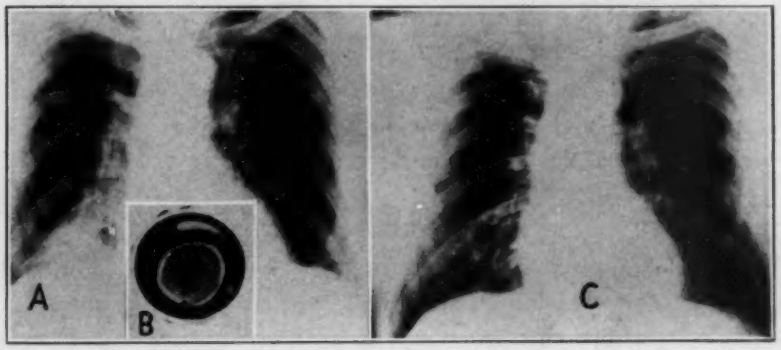

Fig. 12 (case 3).—Localized bronchiectasis in the lower lobe of the right lung, with an obstructing mass of inflammatory tumor tissue blocking a subdivision of the lower lobe bronchus.

A physician aged 52 had complained of repeated attacks of infection of the lower respiratory tract, with productive cough. Before he was admitted to the hospital, the sputum had become slightly blood stained. A roentgenogram (*A*) showed a diseased area in the midportion of the lower lobe of the right lung. Bronchoscopic examination showed a tumor mass (*B*) blocking a central subdivision of the bronchus of the lower lobe. The tumor mass was removed bronchoscopically, and considerable purulent blood-stained secretion was aspirated from the obstructed area. The appearance was that of localized bronchiectasis. After the bronchoscopic procedure the patient's temperature became normal, and a second bronchoscopic examination, one week later, showed the inflammatory lesion to be subsiding rapidly. Good drainage was established, and the patient continued to expel small quantities of mucopurulent secretion for several weeks. The symptoms subsided entirely, and roentgen examination one year later showed the lung to be clear (*C*). Subsequent roentgen examinations during the past eight years have shown no evidence of return of the lesion (films by Dr. Elmer Bertin).

tion of a drug may be limited to the area of lung which it is desired to treat.

In order to approach this subject in the proper way Dr. Joseph P. Atkins and I conducted experiments on living dogs in the department of surgical research, University of Pennsylvania. Sulfanilamide and various derivatives were administered by insufflation repeatedly over a period of days, and the blood levels obtained were noted. The substance was introduced into the left lung, the right lung being used as a control. After a period of such observation and insufflation of the drug, the animals were killed and the tracheobronchial tree and the lungs subjected to gross examination as well as to histologic study. The conclusion we have come to from this experimental study is that sulfanilamide and its derivatives introduced by insufflation in the proper dosage have produced very little reaction in normal lungs. The details of this investigation will be published later, with the results of contemplated additional studies of bronchiectatic patients.

Bronchoscopic Cure of Bronchiectasis in an Early Stage.—Figures 10, 11 and 12 and their legends give information about cases in which bronchiectasis in an early stage was cured bronchoscopically.

SUMMARY AND CONCLUSIONS

The endobronchial approach to the study and treatment of bronchial diseases by means of the bronchoscope is of the utmost importance in the understanding, prevention and cure of these diseases. Bronchiectasis is no exception.

Infections due to aspiration, aspirated foreign body, endogenous foreign body, obstructing secretions and the products of bronchial and pulmonary infection, drowned lung and unresolved pneumonia may be effectively removed with the aid of the bronchoscope. With their removal and aspiration of the distal bronchi, the ventilation and drainage of the area of lung are improved and in many instances restored to the normal state, and bronchiectasis does not occur.

In bronchiectasis occurring as a complication or sequela of infection of the upper respiratory tract with sinus disease, the treatment of the sinus condition alone will not cure the diseased lung. Investigation and treatment of the bronchiectasis by means of the bronchoscope must be carried out coincidentally with the treatment of the sinus condition, if this is indicated.

On the basis of animal experimentation it is hoped that the bronchoscopic insufflation of sulfanilamide or one of its derivatives in proper

dosage will prove an entirely safe procedure in the treatment of bronchiectasis. Bronchoscopic insufflation of suitable medicaments can be limited definitely to the diseased portion of the lung.

The function of the bronchoscopist is to render every possible bronchologic aid to the otolaryngologist, the internist, the pediatrist, the roentgenologist and the thoracic surgeon in the diagnosis, prevention and cure of bronchiectasis.

250 South Eighteenth Street.

Case Reports

ATROPHIC DEGENERATION OF THE COCHLEA IN SYPHILITIC GUMMA OF THE MEDULLA OBLONGATA

M. TAMARI, M.D., CHICAGO

In syphilis of the optic nerve there are definite changes, and the course of extension of the pathologic processes can be partly observed with an ophthalmoscope. However, the syphilitic changes of the ear, particularly of the inner ear, are more complex and irregular and not so widely recognized.

The clinical experiences have not so far been widely verified anatomically; in fact, to date even the classification of terminology has proved difficult. Since the points of attack for syphilis in the ear are so multiple and different, it seems that the problem of classification would have a valuable solution if the methods of aural examination were improved and the localization of the pathologic process in the inner ear could be substantiated.

At present either the classifications are made according to Alexander,[1] who primarily divided the condition into syphilitic neuro-otitis interna, or through a form conditioned by endarteritis syphilitica, or a toxic form, and finally, a gummatous form, or one may agree with those authors who differentiate alterations in the membranes of the labyrinth and the nerve apparatus itself. The medium of attack may be through the labyrinthine fluid, resulting essentially in degeneration of the neuroepithelium, as contrasted to attack on the nerve itself, with degenerative changes of the nerve stem or with peripheral cochlear degeneration, including all three components of the nerve apparatus, viz., ganglion, nerve fibers and hair cells. This last differentiation was confirmed in the pathologic process which follows experimental production of the labyrinthine hydrops and could be used in explanation of a number of degenerative changes.

I should like, therefore, to present the report of a case which was given to me from the collection of the late Professor Neumann, which seems to me to be remarkable because of the postmortem observations on the brain, particularly on the medulla oblongata.

REPORT OF A CASE

History.—A man of 52 who complained of great difficulty in swallowing was sent to the department of medicine of the University of Vienna Clinic. There was a history of an old mercury-treated syphilitic infection. For a year there had been attacks of dizziness, tinnitus and impairment of hearing in both ears; recently there had been deafness, progressive hoarseness for three weeks and difficulty in swallowing.

1. Alexander, G.: (*a*) Die Syphilis des Gehörorgans, Vienna, Alfred Hölder, 1915; (*b*) New Histological Findings in the Ear in Lues and Their Importance in General Pathology of the Ear, Laryngoscope **38**:295-305 (May) 1928.

Clinical Examination.—The examination revealed that he was extremely emaciated. He was completely conscious but complained of intense dizziness, with a tendency to fall backward when he tried to stand or walk. The pupils were unequal, the right one being smaller; examination showed a sluggish reaction to light, no diplopia and horizontal nystagmus to both sides. There was decreased sensibility of the face, particularly of the right side. The face seemed to be asymmetric and immobile. Swallowing was impossible; the voice was hoarse, and the tongue immobile. There was decreased sensitivity to pain on both sides of the entire body. The patellar and achilles tendon reflexes were decreased. In both lungs there were areas of bronchopneumonia. Because of complete deafness, cooperation of the patient was difficult to obtain.

Otologic examination showed that the drums were retracted on both sides and complete deafness was present. The vestibular apparatus was not examined. The soft palate was immobile. Slightly reddened cords of the larynx in abduction were seen.

Death was caused by aspiration pneumonia.

Histologic Examination.—The histologic picture of the two cochleas were practically the same. The middle ear and the eustachian tube showed no pathologic changes. The bony cochlear capsule (fig. 1) appeared normal in its configuration and structure. The modiolus, the spiral tube and the bony spiral lamina were of normal shape. The internal acoustic meatus was only partly filled with preserved nerve fibers, and the greater part of the space was nearly empty. Here and there lay dispersed isolated pieces of destroyed nerve tissue. The periosteum of the meatus was sporadically lifted throughout, and in one place embedded amyloid bodies were seen.

The ganglion cells (fig. 1) were clearly visible in all the coils of the spiral ganglion. Especially where the cochlear nerve was preserved large quantities of nerve fibers passed through between the thin small bony beams of the modiolus, approaching the ganglionic cells, and from here the nerve fibers continued into the canal of the bony spiral lamina, which was best shown in the middle coil of the cochlea. The greater blood vessels of the cochlea were not well filled. They contained a few red blood cells or were filled with serum.

In all coils, the spiral ligament was reduced; the space of the cochlear duct was adequate, and Reissner's membrane was only in some places displaced toward the cochlear duct. The membrana tectoria was in all coils lifted from Corti's organ.

In the lower basal coil (fig. 2) one could see Reissner's membrane pushed forward into the lumen of the cochlear duct, where it lay close to the acoustic crista. The membrana tectoria was shrunken in such a degree that the free part, as well as that part which was adjacent to the crista spiralis, appeared shortened and somewhat displaced.

The crista spiralis (fig. 2) itself showed normal relations to the epithelial lining and to the layers of the connective tissue. The epithelium of the internal spiral sulcus was greatly flattened. Corti's organ appeared largely degenerated. Only very indistinctly could the arch built by the pillar cells be recognized. In the interior of the tunnel, as well as on the periphery of it, were scanty, indistinct nuclei, but the cell limits were hazy and the nuclei appeared to be surrounded by different densely arranged granular masses of cellular protoplasm. Granular, flocculent masses of cellular protoplasm with indistinct nuclei could even be found free in the cochlear duct close to the organ of Corti and partly replacing the cells of Claudius.

The epithelium of the external spiral sulcus was detached and without visible nuclei; the epithelium appeared more distinct above the flattened spiral prominentia. The vascular stria was highly atrophic, and the capillary vessels could not be recognized. The spiral ligament was especially rich in nuclei in the subepithelial dense layers, in contrast to the middle, where it consisted mainly of smaller and larger empty spaces. The tympanal layer of the basilar membrane appeared nearly normal.

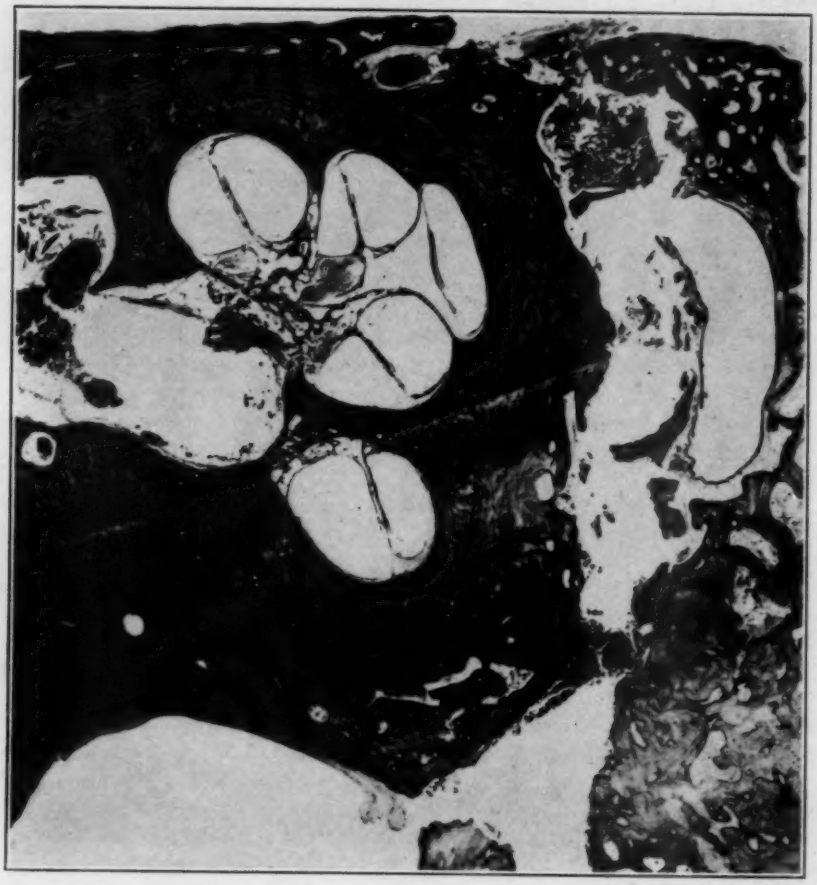

Fig. 1.—Vertical section through the cochlea and eustachian tube.

The space between the two lamellas of the osseous spiral lamina did not contain any nerve fibers and was partly filled with scanty fibers of connective tissue. In the basal part of the crista spiralis, in the spiral ligament near the transition to the membranous spiral membrane and near the spiral prominence there were observed elongated and transverse sectioned capillary vessels which were thickly filled with red blood cells. A greater vessel in the spiral prominence itself was empty.

In the upper basal coil (fig. 3) evidence of degeneration was of less extent. Reissner's membrane and the crista spiralis appeared normal. Corti's membrane was displaced and bent, but not shrunken. The epithelium of the internal spiral

sulcus was very flat and similar to that of the lower basal coil. The pillar and the basal cells of Corti's organ were easily recognized. On the internal slopes one could see irregularly formed nuclei surrounded by granular masses of protoplasm. In lieu of the inner hair cells there was a space. Hensen's group of cells was distinctly flattened, with sharply defined cell limits and with gradual transition into

Fig. 2.—Section through the basal inferior coil of cochlea.

Claudius' cells. The latter were of cubical form, contained a fine granular protoplasm and appeared tasseled.

The epithelium of the external spiral sulcus and of the spiral prominence was flat, and the cell limits were well preserved. The vascular stria, in contrast to that of the lower basal coil, was nearly normal and well defined against the substratum of connective tissue. In some places one could see above the continual epithelial layer some vesicular and some granular cell masses, which probably originated from

destroyed epithelial cells. The spiral ligament was richly nucleated, and the subepithelial stratum, as well as the remaining portion, was loosely woven. Between the lamellas of the bony spiral lamina there was a thin trunk of nerve fibers which

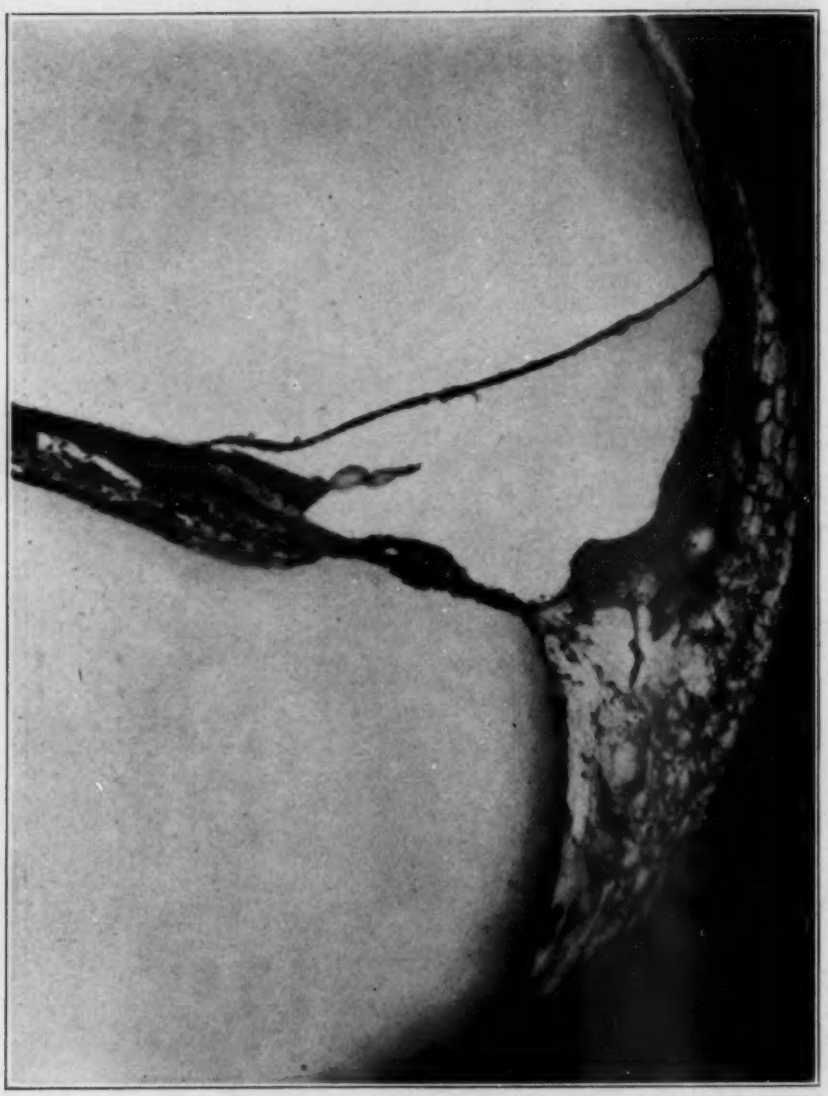

Fig. 3.—Section through the upper basal coil.

were interwoven throughout with cell nuclei. These nerve fibers continued to the foramina nervosa.

Both middle coils were identically preserved. Here, also, Corti's organ was relatively clear and the cells of Deiters still visible. The epithelium of the spiral

prominence was taller and the cells more numerous than in the basal coils. Between the osseous lamellas and the spiral lamina a nerve trunk was perceptible which continued to the foramens (fig. 4). Corti's organ was well preserved in the apical coil. Corti's membrane, the spiral ligament and spiral prominence were analogous to the middle coils.

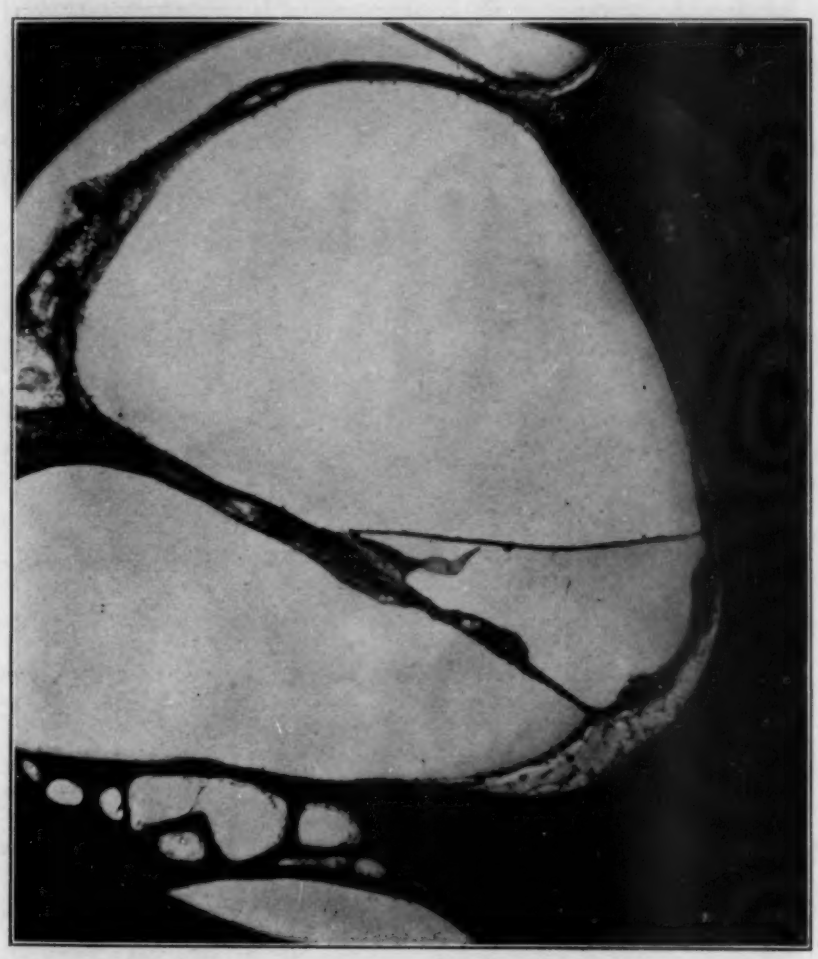

Fig. 4.—Section through the middle coil.

Figure 5 illustrates the basal ganglion. The periosteum of the thin bony lamella which surrounded the ganglion appeared thickened throughout; in some places it appeared still more thickened because of an overlying layer of connective tissue. The ganglion itself was mainly reduced in the portions corresponding to the basal coils. The ganglion cells were very much reduced in number; they appeared round and contained granular protoplasm and distinct nuclei. The connective tissue was profuse between the singular cells, and around the individual cells one could find many nuclei. The fibers of connective tissue passed in disorder

and arranged themselves again properly in the direction of the bony spiral lamella. Nerve fibers were entirely absent, and the nerve canals appeared empty. The ganglions of the middle coils contained more cells and on both sides, approaching the nerve canals, characteristic nerve fibers could be distinguished.

Fig. 5.—Section through the basal ganglion.

The corresponding serial sections of the medulla oblongata prepared in the Neurological Institute of the University of Vienna (Professor Marburg) showed the following changes:

Slides 2, 3 and 4 (Sections at Level of Beginning of Decussation of Lemnisci): There was dense infiltration in Goll's nucleus and less in Burdach's, particularly in the area of the spinal trigeminal root and also around the central canal. There was perivascular infiltration ventrally on one side and to a lesser degree on the

opposite side. The meninges were relatively thin. With Weigert's stain clearing was seen only in the area of the most dense infiltration.

Slide 8: The infiltration was nearly unchanged outside of Burdach's area, and in the area itself a dense aggregation of cells and a distinct infiltration of the meninges and also of all marginal parts were seen up to the spinal root of the trigeminal nerve and beyond. In slides stained with Weigert's stain in this area there was an absence of the most lateral section of Burdach's nucleus and of the beginning of the restiform body. The spinal root of the trigeminal nerve was somewhat pale.

Slide 12 (Section Through Beginning of Olive Region): The densely infiltrated part was now only in the area of Burdach's nucleus, and the spinal root of the trigeminal nerve was infiltrated and took the medullar stains well. The opposite side appeared diffusely stratified and infiltrated, so that the area of Burdach's nucleus as far as to the center on one hand and to half of the trigeminal root on the other did not contain any fibers. The fibers appeared as though they were cut. The pathologic tissue was composed of numerous round cells with bright nuclei, which were mostly in perivascular arrangements and were of lymphocytic character. Along with it there were distinct plasma cells and young granulation tissue (gumma). The borders of the area were more indistinct, and the area itself was free of necrosis. In contrast, there was a definite degeneration of the parenchyma, with swelling of the ganglion cells and of the glia cells in the surrounding tissues.

Slide 16 (Section Through Middle of Olive): On one side the infiltrative character of the process appeared unchanged, and only in the dorsal portion of the olive was it greater. On the opposite side the tumorous character was more striking. The afferent roots were particularly surrounded by the gummatous masses which replaced the whole laterodorsal area. The restiform body, Deiters' nucleus, the spinal trigeminal root and the olivocerebellar pathways appeared cut. The pathologic area ended about in the middle of the fifth spinal root and the olive. A secondary degeneration was not easily recognized, and the whole slide did not stain well.

Slides 18 to 22: There were no substantial changes. The whole vagus nerve was incorporated in the gumma and stained poorly, whereas the contralateral side appeared without any demonstrable degeneration, despite the infiltration. In this area were found the lateral section of Deiters' nucleus, a remainder of Burdach's nucleus, the restiform body, the spinal trigeminal root, olivocerebellar fibers and the fibers of the glossopharyngeal and vagus nerves at their entrance.

Slides 23 to 29: These slides showed a tendency of the tumor to grow more externally than internally to the medulla. The tumor was situated on the roots where the beginning of the cochlear nerve and the area of the lateral recess respectively were distinct and heavily infiltrated. The entrance of the cochlear nerve, the ventral cochlear nucleus, the lateral cochlear root and the tuberculum appeared infiltrated. The ganglionic cells could be recognized but were bloated in some places and the stroma of the fibers around the cells and particularly of the lateral root was diminished. On the more affected right side the fibers of the cochlear nerve could not be recognized. The whole area of Deiters' nucleus and the remainder of the spinal glossopharyngeal roots were absorbed in the outside-growing gumma. The relatively intact appearance of the posterior longitudinal fasciculus and the absence of secondary degenerations were remarkable.

Slide 30: On the less affected side the entire marginal portion was infiltrated. The infiltrated process also affected the cerebellum. On the opposite and more

affected side no trace of the cochlear nerve could be found; it was completely absorbed in the gumma.

Toward the upper end of the olive the infiltration of the less affected side became more dense, particularly with accentuation of the olive area itself and of Deiters' nucleus and the spinal trigeminal root. The entire dorsolateral and lateral region of the more affected side became absorbed by the infiltration. The process extended medially to the beginning of the facial nuclei and reached dorsally to the lateral group of the vestibular nuclei. The adjoining cerebellum was likewise infiltrated. With the first appearance of the superior pedunculi the infiltrating process became a gumma and the facial nerve was totally absorbed in it. The long pathways were relatively in better condition in this area.

The gumma was shown to grow on both sides, into the pons and into the lateral sections of the crura pedunculi. The nucleus of the abducens nerve seemed to be free, but the facial nucleus was entirely affected. The gumma projected also medially above the superior olive. At this point, both facial nerves were in the gumma, and their medullary sheaths lost their stain as they left the brain.

Slides 42 and Those Following: In the region of the entrance of the trigeminal nerve the gummatous infiltration was so situated that both the nucleus and the root lay in the same compact area. The long pathways were still intact here; the pons was as before affected in the lateral parts, and the lateral lemniscus was relatively well preserved. The infiltration disappeared relatively fast at the level of the trochlear decussation, and there were no differences between the fibers on either side in the higher sections. With Weigert's stains there were no further signs of ascending degeneration in this region.

SUMMARY OF MICROSCOPIC OBSERVATIONS ON MEDULLA OBLONGATA

A case is presented of gummatous infiltration of the medulla oblongata from the beginning of the decussation lemniscorum until about the end of the fourth ventricle in the region of the trochlear decussation. The process ran mainly in the dorsolateral boundaries, involving at first one side, infiltrating the nucleus of Burdach, the spinal trigeminal root, the nucleus of Deiters in the cerebellar region and the root and nuclei of the cochlear nerve and finally becoming a gummatous tumor in the nuclear area of the fifth and seventh nerves and ending again abruptly as infiltration above this region.

Although all roots and nuclei lay in the infiltrated area and one could notice only insignificant decolorization of tissue, a genuine secondary degeneration was absent. On the opposite side the process was tumorous from the beginning. The gumma here involved all lateral and dorsal efferent nerves and their nuclei, beginning with the vagus. Further, all lateral and dorsal situated systems, i. e., the nucleus of Deiters, the restiform body, the spinal trigeminal roots, part of the glossopharyngeal root, the olivocerebellar fibers and the outer arcuate fibers, appeared destroyed in specimens stained with Weigert's stain.

Visualizing again the changes in the cochlea in connection with the process in the medulla oblongata and in consideration of the agonal and postmortem changes, one has a picture of a protracted, descending, degenerative process of the cochlea in which the epithelial sensory cells deteriorated as a result of the destruction of the nerve fibers.

TRAUMATIC CANCER OF THE TONGUE

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"The incidence of well-attested traumatic tumors is extremely low" (Ewing [1]). Therefore, it seems justified to report a case of squamous cell epithelioma of the tongue in which the traumatic origin appears to be established as definitely as possible under nonexperimental conditions.

REPORT OF A CASE

A white woman 43 years of age, married, on Feb. 28, 1938 had two teeth pulled, one from the right side of the upper jaw and a molar from the left side of the lower jaw. While the latter was being removed the top of it broke off, and the dentist pinched into the adjacent side of the tongue with his forceps. According to the patient, it was "quite a hard bump because the dentist excused himself and said he broke off the top of the tooth." While the patient was on the way home her tongue began to hurt and burn. After she arrived home she had her husband look at her tongue, and he found that "there was a spot on the side of the tongue where the skin was off." The next morning her tongue felt so stiff that she could hardly move it. She could not eat for two days. The sore did not heal. Five weeks later she reported to the dentist about the consequences of the accident. By July the condition of the tongue had become worse, and the patient consulted a doctor. At his suggestion two more teeth were subsequently removed; but the sore did not heal, and various local medications did not help. On April 17, 1939 the patient was referred to the Marshfield Clinic.

Examination.—The lesion was located on the left side of the tongue laterally, slightly behind the middle. It consisted of a moderately raised red elevation, about 8 mm. in diameter, with an apparently smooth surface. The lesion was surrounded by a slightly elevated edge having the normal color of the tongue. The lesion was soft to the touch. No glands could be felt. Biopsy, however, revealed a squamous cell epithelioma, grade I. The microscopic report (by Dr. Hermann Pinkus) was as follows: "The sections show thickening and definite downgrowth of the epithelial covering with marked atypical changes of the cells. There is a dense lymphocytic and plasmocytic infiltration in the mucosa. While the invasive process does not go very deep, the condition is a definite prickle cell epithelioma, grade I."

Course of the Disease.—The tumor was removed by a wide excision. Microscopic examination showed that the tumor was removed completely and confirmed the pathologic diagnosis. There has been no recurrence up to the time of writing.

THE PROBABLE RELATION OF THE TRAUMA TO THE TUMOR

Ewing listed the following essential criteria in determining the probable relation of trauma to tumors: (1) the authenticity and adequacy of the trauma; (2) the previous integrity of the wounded part; (3) a

From the Marshfield Clinic.

1. Ewing, J.: Neoplastic Diseases, ed. 4, Philadelphia, W. B. Saunders Company, 1940.

reasonable time relation, from three weeks to three years or more in certain cases; (4) continuity of symptoms of the injury with those of the tumor; (5) microscopic or other proof of existence and histologic type of a tumor, and (6) the location of the tumor at the point of injury.

1. Authenticity and adequacy of the trauma. The trauma has been admitted by the dentist. That it was relatively severe is apparent from the ensuing discomfort which arose immediately on the disappearance of the anesthetic. This was attested by the patient's husband and by a friend who went to the dentist with her at the time of the accident.

2. Previous integrity of the wounded part. The patient stated that she had not had any trouble with her tongue prior to the injury. The dentist did not notice previously a pathologic condition of her tongue. Examination of the nonaffected part of the tongue and of the mucous membrane about one year later failed to reveal any sign of leukoplakia or other pathologic changes. This of course does not exclude the possibility that pathologic changes too small to be noticed by the patient or by the dentist had been present at the time of the accident. It seems almost impossible to prove this point beyond any doubt. Even a medical examination prior to the accident would not absolutely exclude minor pathologic changes. Any one who is experienced in examining mucous membranes for dermatologic diseases realizes how frequently minor lesions are overlooked even by careful observers. It seems to us that the previous integrity is demonstrated as well as possible under the circumstances.

3. Reasonable time relation. It is difficult to tell exactly when the epithelioma started. About a year after the injury the condition appeared to be a rather early, infiltrating squamous cell epithelioma.

4. Continuity of symptoms. From the time of the injury until the appearance of the epithelioma the injured part of the tongue never healed. This is attested by witnesses for the first few weeks and later by her attending physician.

5. Proof of the existence and nature of the tumor. The diagnosis of a squamous cell epithelioma, grade I, has been corroborated by two competent histologists.

6. Location of the tumor at the point of injury. This is demonstrated beyond doubt.

COMMENT

This case is presented because the facts are so well attested. It seems to us that in this instance the trauma actually was the trigger mechanism for the appearance of the cancer. When one considers the frequency of trauma of the tongue and the rare occurrence of cancer afterward, one realizes that other factors are involved. A discussion of these factors, however, is beyond the scope of this report.

SUMMARY

A case is reported in which a trauma of the tongue led to a chronic inflammation which in turn gave rise to a squamous cell epithelioma.

THROMBOSIS OF THE CAVERNOUS SINUS WITH STAPHYLOCOCCIC SEPTICEMIA TREATED BY INTRAVENOUS INJECTION OF SODIUM SULFATHIAZOLE, WITH RECOVERY

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Because hemolytic staphylococcic septicemia is so often a fatal disease, especially in conjunction with sinus thrombosis, and because sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) is a relatively new drug used in its treatment, we are reporting the following case with recovery. Other cases [1] of staphylococcic septicemia with recovery in which similar treatment was given have been reported.

REPORT OF A CASE

A white nurse (M. L.) was admitted to the nurses' infirmary of Cook County Hospital on Aug. 5, 1940, with marked edema of the forehead, complaining of a severe headache. Three days before, she had plucked her eyebrows, but with no known injury. The next morning she had some redness and edema over the left eyebrow, but there was no localized point of infection. That day she applied some hot packs and continued the application throughout the next day, working in the ward until 11 o'clock the night before admission.

She stated that in childhood she had had measles, chickenpox and smallpox and that tonsillectomy and adenoidectomy had been performed in 1934.

For the past four years she had had frequent attacks of furunculosis. Soon after entering nurses' training, four years before, she had within a few months eight or nine severe furuncles. At that time she received staphylococcus vaccine, with no improvement. Her last severe infection was an abscess of the hand, about six months before admission.

From the Department of Medicine, Northwestern University, and the Department of Medicine, University of Illinois College of Medicine.

1. Long, P. H.: Sulfathiazole and Sulfamethylthiazole, J. A. M. A. **114**:870 (March 9) 1940. Fitch, T. S. P.: Sulfathiazole in Staphylococcus Aureus: Epidural Abscess with Septicemia and Pyemia, Arch. Pediat. **57**:119 (Feb.) 1940. Stirling, W. C.: Sulfathiazole: Two Cases of Septicemia with Recovery, J. A. M. A. **115**:118 (July 13) 1940. Spink, W. W.; Hansen, A. E., and Paine, J. R.: Staphylococcic Bacteremia: Treatment with Sulfapyridine and Sulfathiazole, Arch. Int. Med. **67**:25 (Jan.) 1941. Keliher, T. F., and Carlen, S. A.: Treatment of Staphylococcal Septicemia with Sulfamethylthiazole: Report of a Case with Recovery, M. Ann. District of Columbia **9**:78 (March) 1940. Herrell, W. E., and Brown, A. E.: The Clinical Use of Sulfamethylthiazole in Infections Caused by Staphylococcus Aureus: Preliminary Report, Proc. Staff Meet., Mayo Clin. **14**:753 (Nov. 29) 1939. Dietel, F. W., and Kaiser, A. D.: Staphylococcus Aureus Meningitis Successfully Treated with Sulfathiazole, J. A. M. A. **115**:601 (Aug. 24) 1940.

Her family history was noncontributory.

She was admitted to the infirmary about fifty-eight hours after the probable cutaneous injury which provided the portal of entry for the infecting organism.

At the time of entrance her temperature was 101.4 F., her pulse rate 104 and her respiratory rate 20.

She did not appear acutely ill and complained only of a headache. There was marked edema of the left eye, extending to the hair line and to the middle of the right eyebrow. The skin was reddish purple and indurated. Over the nasal end of the left eyebrow was a minute black spot surrounded by a yellow areola, an infected hair follicle. There was no cervical adenitis. Other results of the examination were negative. The leukocyte count was 21,000, with 91 per cent polymorphonuclears, and the urine was normal.

The continuous application to the forehead of packs saturated with hot solution of boric acid was begun immediately, and 1 Gm. of sulfathiazole was administered by mouth every four hours. The patient received codeine and phenobarbital for pain. Three hours after admission she had a severe chill; her temperature rose to 104.6 F. and a few hours later was 106 F. Throughout her second day in the hospital her temperature remained around 105 F. Edema of the face increased, involving the right eye and also a portion of the forehead. The patient remained rational.

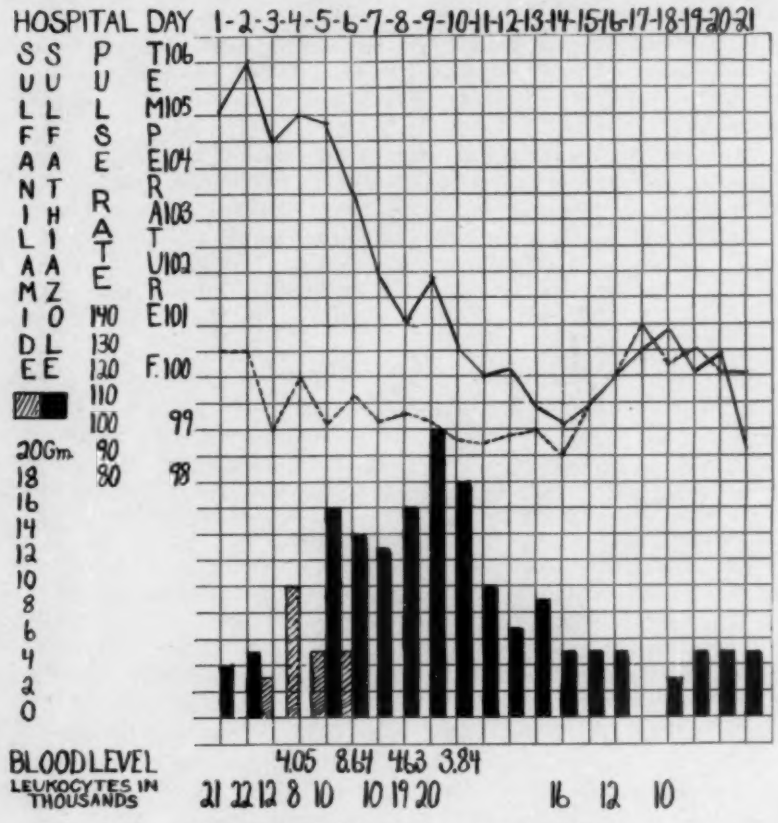
Because there had been no evident response to the administration of 7 Gm. of sulfathiazole in twenty-four hours, and because the appearance and extension of the infection on the forehead suggested erysipelas, it was thought that the etiologic agent was more probably Streptococcus haemolyticus than Staphylococcus. Therefore, sulfanilamide, 1 Gm. every four hours, was substituted for the sulfathiazole. It was not possible to obtain any material from the forehead for smear or culture. On the second day in the hospital the patient received intravenously 2,000 cc. of a 5 per cent solution of dextrose in physiologic solution of sodium chloride, 250 cc. of whole blood and 100 cc. of scarlet fever immune serum. The course of the disease is best understood by referring to the accompanying chart, which incorporates a record of the drug dosage and the blood count.

On her third day in the hospital there was an increase of the edema of the face. Her temperature remained near 104 F., and she complained of severe headache and had projectile vomiting. She was markedly cyanotic, and the leukocyte count was 12,050. She received fluid, as well as 250 cc. of whole blood, intravenously and 4 Gm. of sulfanilamide subcutaneously.

During that night she became irrational and restless. By the morning of the fourth day in the hospital she was semicomatose and did not respond to questions. Her temperature remained near 105 F. She was unable to take fluids by mouth. The edema had extended, involving the entire face and the upper part of the neck. Edema of the eyelids was much more pronounced. There was a reddish cyanotic hue of the forehead, face and mucous membranes, with engorgement of all the superficial veins of the face. Small thrombi could be seen in the vessels of the forehead. Bilateral exophthalmos was evident. Examination of the lungs revealed dulness and rales over the bases of both to the line of the sixth interspace posteriorly. The heart rate was 92, with occasional extrasystoles. The neck was stiff, although the reflexes were normal, with no Brudzinski, Babinski or Kernig sign elicited. There were twitching and spasticitiy of the hands. Perspiration was profuse. The presence of thrombosis of the cavernous sinus was considered

probable, and the pneumonia was considered to be terminal. Again the patient received fluids and 500 cc. of whole blood intravenously and 4 Gm. of sulfanilamide subcutaneously.

On the fifth day there was increasing edema of the face and neck, with more pronounced discoloration and more exophthalmos. Rigidity of the neck continued; the patient appeared moribund. The blood culture was positive for hemolytic Staphylococcus aureus. Thereupon, medication with sulfanilamide was discontinued and the administration of sulfathiazole resumed. She received 8 Gm. intravenously.



Summary of data on the case reported.

Later in the day she was able to swallow and received 7 Gm. by mouth, 1 Gm. being given every two hours.

Throughout the sixth day in the hospital her condition remained almost unchanged except that she was not vomiting and swallowed her medicine well. Occasionally she responded to questions. Edema of the eyelids was somewhat less. Exophthalmos persisted, there was increasing edema of the face and neck and the purplish discoloration extended down onto the right cheek. There was no muscular twitching or change in reflexes. The temperature ranged from 102 to 103 F. Respiration was labored. The level of sulfathiazole in the blood was 8.64 mg. per hundred cubic centimeters.

The next day, the seventh day in the hospital, marked improvement was noted. The patient was receiving 1 Gm. of sulfathiazole every two hours. At times she became rational. She began to take fluids freely, there was less cyanosis and the edema was decreasing. The temperature ranged from 100 to 102 F. Administration of the drug was continued during the next three days—12 Gm. by mouth and, in addition, 5 to 10 Gm. daily of the sodium salt intravenously. Improvement continued, and by the ninth day she was able to open her eyes. Exophthalmos was decreasing. On that day drainage of a thick purulent material began in two areas on the forehead. A diffuse macular rash of the chest and abdomen, obviously a drug rash, was noticed. Red cells were found in the urine.

By the twelfth day the improvement had been dramatic. Intravenous therapy was discontinued. The patient wanted to sit up in bed, took food and had very little edema of the face, although the discoloration continued. The temperature ranged from 99 to 100.4 F.

A roentgenogram of her chest on the twentieth hospital day revealed unresolved pneumonia at the base of the left lung, with some pleural fluid. Paracentesis was done, and a small amount of clear straw-colored fluid was obtained. On culture, the fluid was sterile. On the twenty-third hospital day the administration of sulfathiazole was discontinued. Thirty-four days after entrance to the hospital the patient was discharged to her home, in good condition, although weak. A small amount of pleural fluid remained in the left side of the chest. Later this cleared up entirely.

The oral and intravenous administration of sulfathiazole seems to have been a life-saving measure in this case. The patient received 149 Gm. of the drug in twenty-three days. On one day 21 Gm. was given within twenty-four hours. The only toxic symptoms were moderate vomiting, cyanosis, hematuria lasting two days and a slight rash. Because of the seriousness of her infection, administration of the drug was not discontinued on account of the symptoms.

Throughout the course of the illness, determinations of the level of sulfathiazole in the blood were made frequently. The highest level was 8.64 mg. per hundred cubic centimeters, on the sixth day of illness. In the preceding twenty-four hours the patient received 7 Gm. of the drug by mouth and 8 Gm. of the sodium salt intravenously. At the end of the twenty-four hours in which 21 Gm. was administered (12 by mouth and 9 intravenously), the level was 3.84 mg. per hundred cubic centimeters. The well known fact that sulfathiazole is cleared from the blood more rapidly than sulfanilamide or sulfapyridine (2-[paraaminobenzenesulfonamido]-pyridine) is again illustrated.

COMMENT

We wish to point out several facts concerning this case:

1. The administration of sulfathiazole apparently was the determining factor in saving the life of a patient with staphylococcic thrombosis of the cavernous sinus and septicemia.

2. Large doses of sulfathiazole, even to 21 Gm. per day, were tolerated.

3. Intravenous administration of sodium sulfathiazole proved a safe and effective means of raising the concentration of the drug in the blood.

4. Toxic manifestations from sulfathiazole were mild.

Clinical Notes; New Instruments and Technics

SECONDARY ENDAURAL GRAFTING OF THE CAVITY RESULTING FROM A RADICAL MASTOIDECTOMY

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Many methods have been advocated for obtaining a dry, well epithelized cavity after a radical mastoidectomy. There is evidence that the time necessary to achieve this ideal result plays a part in the relative increase or decrease in the hearing of the ear which has been operated on. It has been suggested[1] that the ears which heal fastest carry the best prognosis in regard to residual hearing. But even if there were not this important problem of hearing to be considered, the financial factor would be sufficient to turn the attention of the otolaryngologist to the gaining of complete healing at the earliest possible postoperative moment.

The never ending quest to improve old technics or to evolve new methods of procedure which will simplify and yet better surgical treatment causes one to view every new product in the light of the part it may play in the field of medicine. Figi[2] described the use of rubber sponge in the treatment of laryngeal stenosis, while Holden[3] suggested the use of this material in the treatment of hematoma of the auricle. This same type of sponge may be applied for the speeding of healing in the cavity resulting from radical mastoidectomy.

ANATOMY OF THE SPONGE

There are at present many different types of rubber sponge on the market, but the one which I have used is "airfoam," marketed under the name "Sponge-Tex powder puff." This is a fine rubber sponge which has air bubbles so small that the surfaces are practically smooth, one side being slightly smoother than the other. My source of supply has been one of the chain 5 and 10 cent stores, where it is possible to purchase rubber powder puffs which are large enough for the purpose here mentioned. The puffs are of flesh color and measure 2½ inches (6.35 cm.) in diameter and ½ inch (1.27 cm.) in thickness. A piece of rubber sponge of this size usually sells for 5 cents, though some of the larger sizes may sell for a bit more.

No difficulty has been encountered in cutting the sponge smoothly to any size or shape desired. When thinning of the sponge is necessary, it is easier to cut on the more uneven surface. Regardless of the side cut, however, no difficulty

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1. Maxwell, J. H., and Richter, H. J.: Radical Mastoidectomy: Its Effect on Hearing, Arch. Otolaryng. **31**:426-430 (March) 1940.

2. Figi, F. A.: Stenosis of the Larynx, Ann. Otol., Rhin. & Laryng. **49**: 394-409 (June) 1940.

3. Holden, W. H.: Injuries of the Auricle, S. Clin. North America **21**:367-370 (April) 1941.

should be encountered in forming a smooth surface. While scissors have been my instrument of choice, comparable results may be obtained with a sharp knife or a razor blade.

TO GRAFT OR NOT TO GRAFT

The postoperative course of a patient who has had a radical mastoidectomy depends on many factors: his resistance, the amount of infection present in the cavity, the aggressiveness of the epithelium, the formation or absence of abundant granulation tissue, the amount of epithelium available to line the cavity at the conclusion of the operation, the completeness of the operation and, last but not least, the meticulousness of the postoperative care.

The ideal postoperative treatment is that which will minimize infection, keep down granulation tissue and promote epithelization—in short, a treatment which will give complete epithelization of the entire cavity in the shortest period. Various methods for achieving these ends have been suggested. It is necessary to do all postoperative dressings with aseptic technic, regardless of what other methods are used.

The problem of controlling granulation tissue has usually been taken care of by (1) applying various chemical agents (silver nitrate, trichloroacetic acid, solution of formaldehyde U. S. P., alcohol and others, which even in the hands of the most careful workers frequently cause destruction not only of the granulation tissue but also of adjoining epithelium), (2) packing and (3) curettage. The attempt to maintain a more or less sterile condition of the cavity has led to the use of other chemicals (such as alcohol, boric acid powder and dusting powders containing boric acid and iodine). Frequent cleansing of the cavity is one of the most important postoperative measures for obtaining this end. Epithelization has been promoted by the use of scarlet red, basic fuchsin or arsenic trioxide. In some instances a combination of scarlet red (amidoazotoluyl) and packing has been used, in the belief that this will keep down the formation of granulation tissue and at the same time encourage epithelization. In at least one instance it has been suggested that the entire cavity be filled with scarlet red ointment at the time of each dressing,[4] while in another[5] the use of a "pepper and salt graft" of skin shavings has been suggested. Despite these procedures healing is all too often a very slow and tedious process which requires months.

Frequently the postoperative course is complicated by the formation of a false drum membrane. Some workers allow this formation to proceed, but the majority believe that there is a potential danger in the formation of a pocket behind the membrane and that it is therefore necessary to discourage the formation of this membrane at the beginning.[6] If one agrees that it is necessary to discourage the formation of membrane and to redirect the growth of the epithelium, one must recognize that there is a resultant loss of time.

It has long been known that many postoperative difficulties can be lessened or even eliminated by the use of skin grafts.[7] However, the relative value of

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4. Lion, H.: Care of Wounds Made in Radical and in Modified Radical Mastoidectomy, Arch. Otolaryng. **32**:520-522 (Sept.) 1940.

5. Lewy, A.: After-Care of Patients Following Radical Mastoid Operation, Arch. Otolaryng. **22**:636-637 (Nov.) 1935.

6. Almour, R.: The Surgery of Chronic Otorrheas, in Kopetzky, S. J.: Surgery of the Ear, New York, Thomas Nelson & Sons, 1938.

7. Robison, J. T.: Radical Mastoid Skin Graft, Texas State J. Med. **29**: 525-528 (Dec.) 1933. Shambaugh, G. E., Jr.: Primary Skin Graft in Modified (Bondy) Radical Mastoidectomy for Preservation of Hearing in Cases of Genuine Cholesteatoma, Arch. Otolaryng. **23**:222-228 (Feb.) 1936.

primary and secondary (or interval) skin grafts has proved to be a point of contention for many years.[8] The introduction of the paraffin basket by Mosher[9] did more to popularize the use of primary skin grafts than any other one thing. There are, however, certain objections to primary grafting. Coming at the end of an already long operation, the grafting is sufficient to discourage many workers. There is also difficulty in obtaining exacting hemostasis. There are, too, a number of cases in which the patient's general condition is such as to contraindicate any extension of the operative procedure or in which the extent of the pathologic change is not accurately known and it becomes desirable to observe the progress for some time before attempting a graft.

It seemed logical, moreover, that a skin graft was more certain to "take" if a short postoperative interval was allowed for the formation of a light layer of granulation tissue, to help supply nourishment and at the same time permit subsidence of any infection. To reopen the posterior wound seemed to involve both a waste of time and a good deal of excess motion; so it was necessary to find some method which would allow the grafting to be done through the external meatus. It was while a simple rapid positive method of implanting interval skin grafts in radical mastoidectomy cavities through the plastic flap in the external canal was being sought that attention first was turned to the use of rubber sponge.

Various other methods were tried, but all of them seemed to lack some essential. The use of wax or paraffin gauze molds was out of the question because of the difficulty of inserting a really form-fitting mold through the external meatus. Removal of these molds was also frequently difficult and painful. The use of a formula[10] containing a wax which melts at a high temperature, poured through the external meatus (the simplest and most successful of previous methods) after the skin has been placed in position in the cavity from the radical operation, often failed because of the uncertainty of the approximation, the difficulty of handling the thin sheets of skin in a confined space and the hit or miss fixation of the skin.

What, therefore, seemed necessary was a method which would (1) allow handling of the skin without fear of having the skin damaged or, on the other hand, of having it curl into a tight unmanageable mass, (2) allow accurate approximation of the skin to the various portions of the cavity regardless of the shape of the recipient area, (3) allow insertion of the graft and the fixing agent through the plastic opening in the wall of the canal and, at a later date, easy, painless removal of the fixing agent, and (4) still give fixation firm enough to encourage a high percentage of "takes." At the same time the entire procedure should be one which presented no great technical difficulties. The use of a very fine rubber sponge as the fixing agent seemed to answer all of these requirements.

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8. Ballance, C. A.: Two Cases Illustrating Epithelial Grafting After the Complete Mastoid Operation, Tr. Otol. Soc. U. Kingdom **1**:69, 1899-1900. Marriage, H. J.; West, C. E., and others, in Discussion on Skin Grafting in Mastoid Operations, Proc. Roy. Soc. Med. (Sect. Otol.) **9**:8-24, 1915-1916. Dench, E. B.: Concerning the Technic of Radical Mastoidectomy, Am. J. Surg. **38**:263-264, 1924.

9. Mosher, H. P.: The Paraffin Basket Mould for Applying a Skin Graft to the Radical Mastoid Cavity, Tr. Am. Otol. Soc. **17**:283-295, 1925.

10. Dagget, W. I., and Bateman, G. H.: Secondary Thiersch Grafting of Radical Mastoid Cavity Through Meatus, J. Laryng. & Otol. **49**:169-174 (March) 1934.

PRELIMINARY STEPS

Certain preliminary steps are necessary, but as they are really an integral part of any well performed radical mastoidectomy, they should give no trouble. At the time of the radical operation, dissection of the mastoid must remove all of the diseased area; the facial ridge should be lowered as far as possible without uncovering or damaging the facial nerve; the middle ear cavity should be made as large as possible; care should be taken to see that there is no pocketing or overhang, especially along the floor of the middle ear and the external canal, and a relatively large flap must be cut, to allow sufficient room for inspection of the entire operative cavity. In the majority of my cases I have used a Jansen modification of the Stacke flap,[6] but the results in cases in which other methods were employed have proved that strict adherence to the use of this type of flap is not imperative.

At the time of the operation the cavity may be packed with either iodoform-treated or plain packing. This packing may be left in place until the cavity is ready to accept the skin graft. In some few instances, in which there is a tremendous amount of infection, it is wise to remove the packing on the seventh or eighth day, to be sure that the cavity is clean enough to receive a graft. It should be emphasized, however, that usually it is possible to unpack the cavity and to implant the graft at the same time—on or about the tenth postoperative day.

There are certain cases in which grafting is contraindicated. These may be grouped generally as those in which deep-lying infection is present or suspected—epidural abscess, brain abscess, petrositis, labyrinthitis, thrombosis of the lateral sinus and facial paralysis. These conditions should be treated by appropriate measures.

METHOD OF GRAFTING

Anesthesia.—Most of the patients on whom I have done grafting by this method have been under general anesthesia induced with an intravenously administered agent. This makes it possible to work while the patient is unconscious and still have him awake by the time he is back in bed. There is, however, no reason why general anesthesia induced by any other technic or even local anesthesia should not be used if desired.

Preparation.—The operative areas are prepared and draped in the usual manner. The donor area, the inner anterior surface of the thigh on the side of the ear which has been operated on, may be prepared with ether and alcohol. I have noted no ill effects from the use of either leg as needed, despite the statement that phlebitis occasionaly occurs when the grafts are taken from the left thigh.[11]

The sponge is prepared by boiling. It is necessary to wrap it in a piece of gauze and weight it with a clamp before it is put into the sterilizer, for if this is not done the sponge will float. In preparation for receiving the skin graft, the smoother surface of the sterile sponge is covered with a very thin layer of petrolatum.

The Graft.—The amount of skin necessary is estimated and an epidermic (Thiersch) graft of this size or slightly larger is cut. (It is interesting to note that grafts approaching intermediate thickness have been used without failure, but

11. Davis, J. S.: Transplantation of Skin, Surg., Gynec. & Obst. **44**:181-189 (Feb.) 1927.

they are not recommended.) The skin obtained is placed immediately, cut surface up, on the previously prepared sponge. Then, by means of a pair of needles the skin is teased into a stretched position. With a little care it is possible to do this without getting any of the petrolatum on the cut surface of the skin. From this point the skin and the sponge are treated as a unit. It will be found that any reasonably gentle handling will be insufficient to cause displacement of the skin, as an additional adhesive quality seems to be imparted to the petrolatum and sponge by the small air holes present. Physiologic solution of sodium chloride should be used to keep the skin moist so that at no time does it become dry.

The interior of the cavity is inspected and thoroughly cleansed of all debris and blood (hydrogen peroxide may be used if necessary). The cavity must be dry; therefore exacting hemostasis is essential. The position for the first graft is then selected. The site of election is that which includes the anterior and inner wall of the middle ear, the upper portion of the facial ridge and the mastoid cavity and the upper portion of the posterior wall of the cavity. When the size of the graft has been estimated, the sponge-skin unit is cut to pattern. It will be necessary to taper in both thickness and width the end of the strip of sponge which is to be placed in the middle ear cavity. When this has been done, the tapered sponge and overlying skin are doubled, so as to form a U of rubber, with the skin on the outer surfaces. The edge of the sponge and skin can be grasped with a forceps; then, with a blunt probe in the interior of the U, the skin and sponge are introduced into the cavity, care being taken that the tapered end is placed well down and snugly into the middle ear portion of the cavity. A certain amount of compression will be necessary to effect this insertion, but, as the fine rubber sponge can be compressed to less than one half of its original thickness, no difficulty should be experienced here.

At this point it will appear that all of the sponge possible has been squeezed into the cavity, but actually there is very little compression of the sponge and thus very little fixation of the skin. There is also a large surface of the cavity in the lower portion which has not been covered by graft. Therefore, it is necessary to cut another strip of skin-sponge unit, to fit the lower portion of the cavity. Insertion of this is easily performed when the upper, previously placed sponge has been compressed. This procedure is merely a laying of the sponge-skin unit in the desired area and position. Release of the compression of the sponges now will supply sufficient fixation to hold the entire graft in place. If, however, it is felt that there is insufficient compression or fixation, it is a simple matter to place a small wedge of rubber sponge between the units in place. In most instances two pieces of skin can be so applied to cover the cavity more or less completely, but a third piece can be used if necessary.

It is not necessary to cover every portion of the cavity with skin, nor does it seem desirable, as the areas between the grafts act as paths for drainage and are readily and rapidly epithelized from the ingrafted skin soon after the removal of the fixing sponges. The sponges are self retaining, and no further treatment other than the changing of the external dressing as circumstances may require is necessary until they are removed. There will be a certain amount of serous discharge from the cavity since little damming action is exerted by the sponge. The edges of the graft which are over skin rather than unepithelized areas will slough, and this will cause some increase in the discharge as well as a certain amount of odor but will result in no real harm. The sponge may be removed on the eighth to the tenth day, and at this time any sloughed edges may be trimmed with a pair of

fine scissors. Nothing is to be gained by taking the sponge out earlier, for disturbing of the sponge pack will only cause interference with that portion of the graft which is in the proper position.

The entire procedure may be carried out in less than fifteen minutes, once the method is understood. The percentage area of grafted skin which "takes" is high, and it is possible to send the patient home twenty-four hours or less after the graft has been placed in position.

AFTER-CARE

After the removal of the sponges little treatment is necessary. The less manipulation required to keep the cavity clean the better, for there will be less danger of injuring the very fine and almost invisible epithelium. If there is granulation, it can be controlled by careful exact application of silver nitrate with a finely cotton-tipped probe. Packing rarely is needed unless the graft in the middle ear has failed to "take," in which case it may be necessary to hold down the granulations in this area with a small piece of packing—preferably one which has been impregnated with scarlet red or basic fuchsin

REPORT OF CASES

A brief summary of the course of 5 successive patients who had been treated with skin grafts implanted by the method outlined follows:

CASE 1.—P. R., a 21 year old white woman, had a skin graft inserted ten days after a radical mastoidectomy. The sponge packing was removed on the tenth day after the grafting. On one occasion it was necessary to touch some granulation tissue with silver nitrate. Forty-two days after the grafting the cavity was completely epithelized and dry.

CASE 2.—G. H., a 12 year old white boy, had a skin graft inserted eight days after a radical mastoidectomy. The sponge packing was removed ten days after the grafting. The patient had a slight amount of mucoid discharge in the region of the eustachian tube. One month after the grafting there was complete epithelization of the cavity, but there was still a slight amount of mucoid discharge in the region of the eustachian tube. Three months after the operation there was still a slight amount of mucoid discharge, but this caused the patient no trouble. During the period after the removal of the sponge packing, insufflations of boric acid powder were used.

CASE 3.—J. B., a 27 year old white man, had a skin graft inserted eleven days after revision of a radical mastoidectomy. On the eighth day after the grafting the sponge packing was removed. Three months later the cavity was healed and dry. After the removal of the sponge packing, silver nitrate and a pack impregnated with basic fuchsin were used in the cavity.

CASE 4.—D. B., a 25 year old Negress, had her tonsils and adenoids removed seven days after a radical mastoidectomy. Fourteen days after the mastoidectomy a skin graft was placed in the cavity. Eight days later the sponge pack was removed. Forty-five days after the insertion of the skin graft the cavity was dry and healed. During the first part of the postgrafting course there was a little discharge in the region of the eustachian orifice. Silver nitrate and a pack impregnated with basic fuchsin were used in the postoperative course.

CASE 5.—A. W., a 34 year old white woman, had a skin graft inserted eight days after a radical mastoidectomy. On the ninth day after the grafting the sponge

packing was removed. Fifty days after the grafting the cavity was dry, but there was a very small unepithelized area on the floor of the middle ear. During the postoperative course silver nitrate was used.

At the time of writing, indications are that there will be relatively good hearing as compared with that present preoperatively in the cases reported here. However, the series of cases is much too short and the time much too early to warrant any statements on this phase of the problem. This will, if possible, be analyzed at some later date.

COMMENT

The addition of a graft to the cavity resulting from a mastoidectomy markedly shortens the postoperative course. The fact that the pack inserted at operation can be removed with the patient under anesthesia at the time the grafting is performed contributes to the patient's comfort. There can be no objection to an additional operative procedure as simple and as effective at this. (It takes little more time than the first dressing of the cavity, which often is done with the patient under anesthesia.) The use of fine rubber sponge, which is easily removed, allows an automatic adaption of the graft to the configuration of the walls of the cavity, with a pressure which is sufficient to insure retention of the graft but which is not sufficient to cause compression necrosis or damming of secretion.

SUMMARY

The desirability of performing a skin graft to shorten the postoperative course following a radical mastoidectomy is pointed out. A method for doing endaural interval skin grafts in a simple, effective and rapid manner is given.

INTUBATION FOLLOWING OPERATION FOR COMPLETE CICATRICIAL STENOSIS OF THE NASOPHARYNX

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It is generally agreed that acquired stenosis of the pharynx is produced usually as the result of infection, syphilis being most frequently the cause. The other common cause is trauma. The rarity of the condition is probably accounted for by the mobility of the palatal and pharyngeal muscles. According to Moore,[1] peritonsillar abscess, retropharyngeal abscess and deep abscess of the tongue are most frequently the factors that contribute to acute stenosis, although the inflammatory process following tonsillectomy and adenoidectomy occasionally produces cicatricial stenosis of the pharynx. The inflammatory process must be sufficient to immobilize the palate and bring it into immediate contact with the faucial pillars and ultimately with the posterior wall of the pharynx. The symptoms are obvious: The voice is muffled; there are inability to breathe through the nose, difficulty in swallowing, dryness of the pharynx from mouth breathing, irritation of the nasopharynx from accumulation of secretions, pain in the ears from distur-

1. Moore, R. S.: Acute Stenosis of Pharynx, New York State J. Med. **38**: 434 (March 15) 1938.

bance of pressure in the nasopharynx and impairment of the sense of smell, and if the stenosis persists for any length of time the sinuses become affected.

LeJeune [2] mentioned a variety of treatments, most of which have been unsuccessful. These include: incision of the scar, followed by dilation; plastic operations; the use of the cautery; the use of prosthetic appliances. He reported 2 cases in which treatment after the method described by Nichols in 1896 was successful. This consists of producing epithelized tracts laterally into the scar tissue, to which incisions can be made without recurrence of adhesions. These tracts are produced by inserting silk braid ligatures laterally into the region of the scarring. The rationale of this procedure is probably sound if only the orifice of the nasopharynx is occluded. If the cicatrix extends for any distance up into the nasopharynx, difficulty will be experienced in passing sutures up beyond the area of scar tissue. This is particularly true if the patient presents the typical adenoid facies, with a high, narrow palatal vault and consequent diminution in the lateral dimensions of the pharynx.

OPERATION

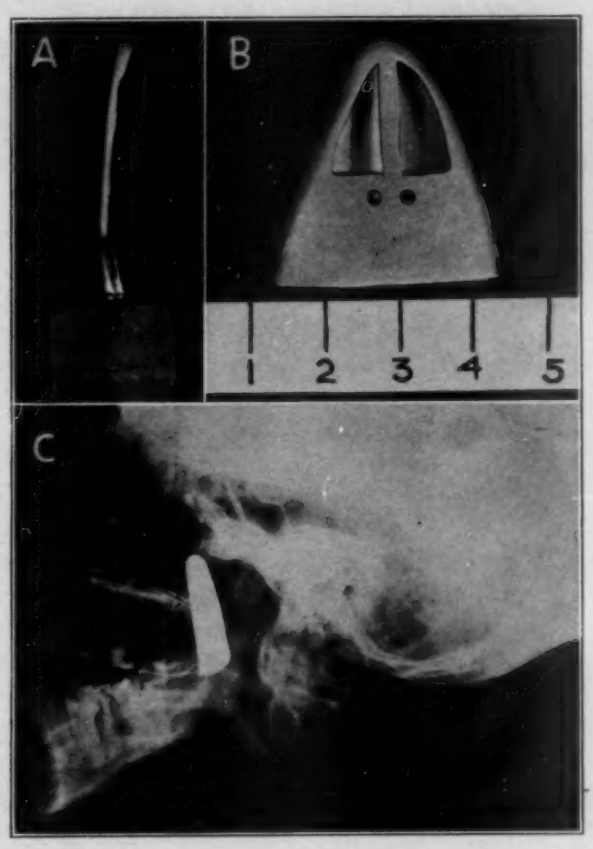
The selection of anesthetics for use with this operation is important. Avertin with amylene hydrate is recommended for the basal anesthesia and procaine hydrochloride with epinephrine hydrochloride for local infiltration. The dissection is begun in the midline and is carried laterally first on one side and then on the other, avoiding injury to the soft palate as far as possible, since a slight cicatrix at this point may ultimately interfere with proper enunciation: one is mindful, likewise, not to encroach on the tubal ridge, as cicatricial closure of the eustachian orifice may follow. This procedure is not carried out without considerable danger from hemorrhage, as the surgical landmarks are largely obliterated and there is no way of determining how far the important structures in relation to the lateral walls of the pharynx, such as the internal carotid artery, the vagus nerve, and the glossopharyngeal and hypoglossal nerves, may be drawn forward and toward the midline. Consequently, the surgeon must be alert to the dangers and be prepared to meet such emergencies as ligating the internal carotid artery. Should this become necessary, time will be saved by occluding the common carotid artery temporarily, as this vessel can be approached directly with greater speed and less danger. After the emergency has been controlled, one can more leisurely follow the dissection up to ligate the internal branch. The second danger is latent—from the cerebral changes which can follow ligation of this vessel. After the nasopharyngeal space has been restored and hemostasis established, a small rubber catheter is passed through each side of the nose and brought out through the oropharynx. The catheters are clamped in front of the nose, and an assistant gently pulls the pharyngeal ends of them forward and laterally, to separate the soft palate from the surrounding structures.

TAKING AN IMPRESSION

The securing of an accurate impression of the nasopharynx in a living subject is a highly technical procedure. An ideal impression material, such as one of the hydrocolloids, cannot be used, because of the danger of detached particles' falling into the trachea. Consequently, a dental compound or a combination of this material with a low-fusing wax offers the safest means. A special tray is designed to meet the anatomic needs of the parts, as the impression tray must be lowered

2. LeJeune, F. E.: A Review of the Available Literature on the Pharynx and Pharyngeal Surgery for 1938, Laryngoscope **49**:1043 (Nov.) 1939.

practically to the piriform fossa of the larynx before carrying the impression material, which must reach the roof of the nasopharynx. When the impression material is being carried to place, it is necessary to establish the relation of the floor of the choanae. This is essential in order that the openings in the tube may conform to those of the posterior nares, to facilitate drainage. From this impression a model is made in stone. This model, however, is not an accurate reproduction of the part, because the anatomic relations are necessarily altered by the



A, lateral view and, *B*, front view of tube. *C*, roentgenogram showing the tube in position. Note the retention wires above the floor of the nose and the control wire in the mouth.

compression produced in carrying the impression material to place. In order to correct this distortion, the pharyngeal walls are carefully palpated, and the model is relieved according to the resistance found on palpation. Should the tube be made directly from the model, undue pressure would be applied over the more resistant areas, with a possible sloughing of the tissues. Optimal contact is essential and can be secured only by altering the model as described. The sensory areas, particularly those that tend to initiate gagging and coughing reflexes, are

consequently relieved. Immediately after the operation I insert a temporary transparent acrylic resin tube (lucotone, which can be processed immediately) to maintain the space until a vitallium tube can be cast. The material used for retention must be a hard, solid substance, in order to control the sphincteric action of the pharyngeal muscles. The vitallium tube is worn from four to six weeks, a sufficient time for complete epithelization to occur, and is retained by wires passed through each nasal fossa, as shown in the roentgenogram (fig., *C*), and fixed on the face with adhesive tape. The lower wire, which is to control the tube, comes out through the mouth and is also fixed on the face. While this procedure takes considerable time and must be carried out with precision, the fact that the normal dimensions of the nasopharynx can be thus restored amply rewards one for the time and patience required for correcting the most distressing complications following surgical treatment of the throat.

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Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

TUMORS OF THE NOSE AND THROAT

GORDON B. NEW, M.D.
AND
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For the last eight years at the Roentgen and Light Institute, in Cologne, Germany, Coutard protracted roentgen therapy has been in use. Glauner, Teufel and Daigger [1] reported its use in cases of malignant tumors of the mouth, pharynx, hypopharynx and larynx. In analyzing their statistics, they found that results of the treatment of cancers of the mouth, pharynx and hypopharynx by Coutard's method do not compare favorably with results from surgical intervention reported by other clinics. A possible exception was made for carcinomas of the larynx and highly malignant types of growth in the pharynx and the tonsillar region. In cases of growths in these locations, they asserted, any comparison of the Coutard therapy with surgical intervention is not entirely convincing, since operation often is attempted first.

Lierle [2] reviewed 169 cases of epidermoid carcinoma which involved the buccal mucosa, pharynx or larynx. All patients had been observed for three to seven years at the State University of Iowa. As a result of this study, Lierle commented that (1) all localized differentiated lesions respond better to operation or to operation combined with irradiation than to irradiation alone and (2) advanced malignant lesions and undifferentiated tumors do not respond well to any treatment, but irradiation is of definite value in such instances, as symptoms often are relieved for months or years. The author expressed the opinion that early recognition of malignant lesions is one of the most important problems to be solved.

From the Section on Laryngology, Oral and Plastic Surgery, the Mayo Clinic.

1. Glauner, R.; Teufel, S., and Daigger, A.: Ergebnisse der protrahiert-fraktionierten Röntgenbestrahlung der Karzinome der oberen Luft- und Speisewege, 1930 bis 1938, Strahlentherapie **65**:397-408, 1939.

2. Lierle, D. M.: Epidermoid Carcinoma of the Pharynx, Buccal Mucosa, and Larynx, Ann. Otol., Rhin. & Laryng. **48**:875-885 (Dec.) 1939.

A study of malignant disease of the face, mouth, pharynx and larynx in 233 patients who were in the first three decades of life was conducted by Hertz and one of us (G. B. N.) [3] at the Mayo Clinic. It was discovered that among patients in the first two decades of life the distribution by sex was about equal, while among those in the third decade there was a great predominance of men. Twelve per cent of the lesions were sarcomas, and 88 per cent, carcinomas. The results of treatment, which consisted of operation, irradiation or both, depending on the type of tumor, were interesting. Among patients who had basal cell or combined basal cell and squamous cell epithelioma of grade 1, the five year survival rate was 100 per cent. Eighty-eight per cent of the patients who had adenocarcinoma of the mixed tumor type were alive five years after treatment. For patients who had sarcoma the prognosis was poorer. Fifty-four per cent of those who had fibrosarcoma were alive five years later. Only 22 per cent of those with lymphosarcoma lived five years. The prognosis for malignant disease of the tongue, palate, tonsil, pharynx, upper jaw and antrum, lower jaw and larynx among young persons is considered poor. However, the following data on survival were obtained:

Location of Malignant Disease	Number of Patients Traced	Years After Treatment	Number of Patients Living	Percentage of Patients Living
Tongue, palate, tonsil, pharynx, upper jaw and antrum, lower jaw and larynx	73	5	24	32.9
	36	10	11	30.6
Lip	111	5	56	50.4
	63	10	32	50.7

TUMORS OF THE LIPS AND MOUTH

An attempt was made by Wilson [4] to correlate the rate of ulceration in 1,265 cases of epithelioma of the skin and lip with such factors as grade of malignancy, type of previous treatment, site of the lesion and age of the patient. In the cases of squamous cell epithelioma, the rate of ulceration was found to be in direct proportion to the grade of malignancy except in the case of lesions of grade 4, which were found to ulcerate at a rate between those of lesions of grade 1 and 2. Previously treated epitheliomas were found to ulcerate more rapidly than those which had not received treatment. In the cases of recurrent epithelioma, the rate of ulceration was found to be most rapid in growths which were treated with salves and pastes. In general, ulceration was discovered to occur more rapidly among persons more than 56 years of age than among younger persons.

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3. New, G. B., and Hertz, C. S.: Malignant Disease of the Face, Mouth, Pharynx and Larynx in the First Three Decades of Life, Surg., Gynec. & Obst. **70:** 163-169 (Feb.) 1940.

4. Wilson, W. D.: Rate of Ulceration of Epitheliomas of Skin and Lip, Arch. Dermat. & Syph. **41:**667-677 (April) 1940.

Daland [5] described an operation for the reconstruction either of the upper or of the lower lip if any amount less than the total width of the lip was cut away during the removal of cancer. This operation consists of excision of the cancer by a rectangular incision; flaps are then constructed from the lateral borders of this wound in order to reconstruct the lower lip. The advantage of this operation, Daland stated, consists in leaving a completely intact musculature; the only disadvantage is a reduction in the size of the mouth. Not only were the cosmetic and functional results of this operation said to be good, but as a curative measure it appeared to be adequate. However, few of the patients had been followed for more than three years. Twenty-three cases in which this operation had been used were presented.

Boyer [6] described the removal of small malignant lesions from the lower lip by a V-shaped incision. He suggested the Estlander operation as a means of reconstruction of the lip when large growths were removed.

In an analysis of a series of cases of epithelioma of the lip, Carter [7] summed up his opinions on this subject in the following manner: 1. Early, uncomplicated cancer of the lip is curable in 100 per cent of cases by roentgen or radium therapy or operation only. 2. Cancer of the lip does not tend to metastasize early and if discovered soon usually does not require any treatment of the glandular region. 3. In cases in which the lesions are of a high degree of malignancy, as evidenced by pathologic grading, rapid growth and longer duration of glandular involvement, the lesion should be treated with roentgen rays or radium or by operation preceded by therapy with roentgen rays or radium. The glandular region should be treated by intensive roentgen rays or radium for an extended period; in occasional cases glandular dissection is required. 4. The necessity for routine, wide excision of the glandular region in all cases of epithelioma of the lip was not borne out by the results obtained.

From 1917 to 1935, 175 patients with cancer of the skin and lip were treated at the Erlangen Roentgen Institute, Erlangen, Germany. For statistical purposes, Horvath [8] divided the tumors, in accordance with their degree of extension, into four stages, as follows: (1) small, movable, localized lesions which had not metastasized and which were operable, with good cosmetic results; (2) primary tumors which were

5. Daland, E. M.: Repair of Large Defects After Removal of Cancer of the Lips, Surg., Gynec. & Obst. **69**:347-357 (Sept.) 1939.

6. Boyer, B. E.: Reconstruction of the Lip in Carcinoma, J. Med. **20**:543-544 (Feb.) 1940.

7. Carter, L. J.: Epithelioma of the Lip, Canad. M. A. J. **40**:569-571 (June) 1939.

8. Horvath, J.: Die Röntgenbehandlung des Haut- und Lippenkarzinoms, Strahlentherapie **65**:216-236, 1939.

extensive and fixed to the underlying tissues, but which were still operable with poor cosmetic results, and had not metastasized; (3) extensive primary lesions with regional metastasis which were mostly inoperable, and (4) inoperable primary lesions with regional and distant metastasis. Small primary lesions with distant metastasis were also included in this last group. Of the patients living and well five years after treatment, 91.1 per cent had had lesions in the first stage, 48.1 per cent had had lesions in the second stage and 12.9 per cent had had lesions in the third and fourth stages. The author recommended that operation and irradiation should be used in conjunction and that there should be close cooperation between surgeon and radiologist.

According to Chont,[9] both surgical and radiation treatment give satisfactory results in cancer of the lip if applied early and adequately, but a thorough search of the literature revealed that radium treatment gives a higher percentage of cures than do other methods. Chont's final statistics, based on treatment of cancer of the lip with interstitial radium, disclosed 86.8 per cent of cures up to a recent date, including 6 deaths caused by intercurrent disease. If the 6 deaths are disregarded, 75.4 per cent of the patients were cured.

Hunt[10] concluded that for eradication of carcinoma of the lip surgical excision is a safer procedure in inexperienced hands than is radiotherapy. However, it was the author's opinion that correctly administered roentgen rays and radium are as effective as proper surgical procedures in controlling the primary lesion in cancer of the lip or skin. Types of radiation for various kinds of lesions were considered.

According to Smithers,[11] primary carcinoma of the lip responds well to several forms of treatment; the balance, however, is in favor of irradiation. Methods with short distance low voltage roentgen therapy, he asserted, present several advantages. Treatment to the neck is not advised in early stages in which there is no clinical involvement of the lymph nodes, but small, movable lymph nodes are best treated surgically. Large, fixed lymph nodes should be given palliative treatment by irradiation alone.

Sharp and Smith[12] advocated radium in the treatment of leukoplakia and superficial cancer of the lip. They considered that advanced, infil-

9. Chont, L. K.: Interstitial Radium Treatment of Cancer of the Lower Lip, J. Oklahoma M. A. **32**:334-337 (Sept.) 1939.

10. Hunt, H. B.: Cancer of the Lip: A Consideration of Its Prophylaxis, Diagnosis and Treatment, Nebraska M. J. **25**:133-137 (April); 187-189 (May) 1940.

11. Smithers, D. W.: The Treatment of Carcinoma of the Lip, Post-Grad. M. J. **15**:376-381 (Nov.) 1939.

12. Sharp, G. S., and Smith, H. D.: The Treatment of Cancer of the Lip, West. J. Surg. **47**:695-705 (Dec.) 1939.

trating cancer was removed most effectively by the use of surface radium, followed by interstitial implantation of radium within a week. In the case of extensive or infected growths, they claimed that greater efficiency and success were attained by wide surgical removal and immediate plastic repair. For advanced fungating cancer, the authors advised removal of the bulk of the growth by means of diathermy and subsequent application of radium.

In treating superficial cancer of the lips, Trueheart [13] recommended radiation, either with roentgen rays or with radium, in the majority of cases. However, a radioresistant tumor often is best treated by electrosurgical methods. Trueheart stated that he does not perform routine block dissection of glands or use heavy prophylactic radiation of the neck routinely but reserves these measures for cases in which the glands are palpable, metastasis is evident or the primary lesion is extensive. The author's statistics were not convincing, as the rate of five year survival free from carcinoma of the lip was 84 per cent, including all untraced patients and 72.5 per cent if all untraced patients were regarded as dead.

At the Norwegian Radium Hospital, Oslo, Norway, from 1932 to 1935, 147 malignant tumors of the lip were treated with radium (needles and radium bomb), according to Engelstad.[14] Metastatic lesions to the lymph nodes were dissected surgically, and in addition the patients were given irradiation. Engelstad stated that this method of treatment for primary carcinoma of the lip insured better results than those obtained by surgical removal. Furthermore, the cosmetic result was more desirable.

Taylor and Nathanson [15] presented a rather detailed discussion of dissection of the cervical glands for carcinoma of the lip. The tables presented were based on 616 cases of carcinoma of the lip, in 19 per cent of which the nodes were involved. There were 51 per cent of cures in those cases in which nodes were involved. On the basis of their findings in this study, they offered the following indications for carrying out cervical dissection: 1. In cases in which the lymph nodes are not palpable or are less than 1 cm. in diameter, dissection might be deferred, providing the patients can be followed carefully. 2. In cases in which the lymph nodes are larger than 1 cm., dissection should be performed as part of the original treatment. 3. Dissection of cervical glands should not be carried out unless there is a considerable degree of confidence that the local process in the lip has been, or can be,

13. Trueheart, M.: Superficial Cancer—Skin and Lip, J. Kansas M. Soc. **40**: 419-423 and 430 (Oct.) 1939.

14. Engelstad, R. B.: Radiologische Behandlung des Lippenkarzinoms, Strahlentherapie **64**:571-589, 1939.

15. Taylor, G. W., and Nathanson, I. T.: Evaluation of Neck Dissection in Carcinoma of the Lip, Surg., Gynec. & Obst. **69**:484-492 (Oct.) 1939.

corrected. The authors expressed a preference for routine, unilateral, superhyoid dissection, unless the lesion of the lip extended to the midline. However, if obvious glandular involvement is present, more extensive operation is desirable. Follow-up observation was recommended routinely after dissection, with special attention to lymph nodes on the opposite side of the neck and beyond the limits of dissection. Secondary dissection, they stated, often is successful if it is undertaken promptly. It is difficult, they declared, to define the borderline between operability and inoperability as regards cervical nodes, since occasional cures of apparently incurable conditions might be achieved by radical procedures. Their method of management in cases of inoperable metastasis to the cervical nodes was roentgen therapy. So far, they stated, they had not cured many patients who had known metastatic involvement.

In a discussion of the life expectancy and mortality of patients who had epithelioma of the skin or lip, Peller [16] concluded that at the onset of the disease, the age of carriers of an epithelioma of the skin or lip is about the same as that for all other patients who have cancer. At the time of death, however, patients who have cancer of the skin or lip are older. Patients who have cancer of the skin and lip and are less than 60 years of age have, in the author's opinion, an increased mortality and a shortened life expectancy, as compared with the average population at the same age, while patients more than 70 years of age at the onset of epithelioma have a lower mortality and a higher life expectancy. At the beginning of the "cancer age," 40 years, the total group of future carriers of a surface cancer most probably have a greater chance of living longer than is average for the total population of the same age. This was thought to indicate that primary internal cancer developing among those who already have or have had surface cancer is not frequent enough to diminish the life expectancy in this group or to frustrate the value of treatment of surface malignant lesions.

Figi [17] presented a general discussion of malignant tumors of the mouth, including squamous cell epithelioma, adenocarcinoma, adamantinoma and various forms of sarcoma. These tumors were discussed from the standpoint of their location within the mouth, diagnosis, prognosis and treatment. In a series of 942 patients with cancer of the lower lip treated at the Mayo Clinic during a ten year period, it was found that recurrences took place either locally or in the lymph nodes almost four and a half times as often when treatment had been given prior to the patient's registration at the clinic as when there had been no previous treatment. Approximately 90 per cent of the patients whose

16. Peller, S.: Life Expectancy and Mortality from Skin and Lip Cancer, Am. J. M. Sc. **199**:449-458 (April) 1940.

17. Figi, F. A.: Malignant Diseases of the Mouth, J. Am. Dent. A. **26**:1979-1986 (Dec.) 1939.

lymph nodes were not involved remained well for five years or more. Of 162 patients treated for cancer of the tongue, 156 were traced; 37.2 per cent of these were found to be alive five years or more after operation.

Carling [18] stated that the treatment of malignant disease of the lips and mouth is exclusively irradiation, although surgical intervention, especially surgical diathermy, has a part to play. The author urged early biopsy.

In a study of 35 unselected cases of carcinoma of the cheek treated by means of weak radium needles, Martin [19] reported that in 40 per cent the patients were well for two and a half to nine years. By careful dosage, Martin said, seven to eight threshold erythema doses can be delivered uniformly to intraoral tumors by placing weak radium needles parallel to one another in and around the lesions for seven days.

Roh [20] reported the case of a woman aged 71 who had a myeloma which involved the upper alveolar border on the right and the antrum. After preliminary ligation of the right external carotid artery, this tumor was removed by partial resection of the right superior maxilla. Treatment with irradiation was then employed, and a similar tumor subsequently developed on the lower left jaw, which was removed by means of diathermy. Two weeks later the patient died suddenly of unknown cause. Necropsy was not carried out. The early use of radium or roentgen rays after radical removal of such a tumor was advised. The author recommended instillation of iodized poppyseed oil into the antrum through the normal osteum for diagnostic purposes, especially if it is suspected that the lower half of the antrum is involved.

Thirteen cases of intraoral and nasopharyngeal tumors were reported by Kaikini.[21] Of the 13 tumors, 10 involved the maxilla itself and 3 the nasopharynx. Of the 10 tumors of the maxilla, 4 were carcinomatous and the rest sarcomatous, and the 3 nasopharyngeal growths consisted of 1 sarcoma and 2 fibromas. According to the author, early removal of the maxilla for malignant lesions gave brilliant results. Furthermore, in cases of malignant tumor of the maxilla in an advanced stage, in which the maxilla was excised and the patient died of secondary growth, death was less painful than it would have been had the bone not been removed completely.

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18. Carling, E. R.: Malignant Diseases of the Lips and Mouth, Practitioner **143**:584-595 (Dec.) 1939.

19. Martin, D. D.: Weak Radium Needle Technique in Carcinoma of the Cheek, Am. J. Roentgenol. **43**:226-236 (Feb.) 1940.

20. Roh, R. F.: Primary Mixed Cell Myeloma of the Mouth Involving the Antrum, Arch. Otolaryng. **31**:669-674 (April) 1940.

21. Kaikini, V. M.: Tumours of Upper Jaw and Its Immediate Neighbourhood, Indian M. Gaz. **74**:406-409 (July) 1939.

In a review of the literature, Baxter [22] presented the case of a Negro who had a malignant melanoma which originated in the mouth. The author stated that malignant melanomas are the same histologically in the white race as in the colored races and that the amount of pigment present is no criterion for estimating the degree of malignancy. Trauma was assumed to play an important part in causation. Of interest is the fact that melanotic tumors of African natives frequently remain localized; those of the American Negro are more malignant.

According to Breuekmann,[23] melanomas of the oral mucosa are comparatively uncommon and are found more frequently among men and among persons who have dark hair and skin. Melanomas develop in melanoplakia, which has a clinical significance corresponding to that of leukoplakia but is not encountered as often. Such melanomas are of a high grade of malignancy. In the case presented by Breuekmann, the tumor originated on the hard palate and gum tissue of the upper jaw. It was suggested that the formation of melanin probably was due to continuous irritation arising from unusually bad teeth. The patient was a man aged 65. He was given irradiation treatments, with marked improvement. At the time the article was written he was still being treated.

On considering the radiosensitivity of various epitheliomas of the mouth, Zwingli [24] attempted to answer the following questions: 1. Is there a difference in the sensitivity to irradiation between the skin type and the mucosal type of squamous cell carcinoma? 2. Is there any difference in the sensitivity to irradiation between these types of tumor as far as location is concerned? At the Pathologic Institute, Zurich, Switzerland, from 1916 to 1935, 1,849 biopsies were carried out. Of the 687 squamous cell carcinomas found, 456 were cutaneous, 127 were mucosal and 104 were of a mixed type. Analysis of these tumors revealed the following facts: (1) The mucosal type is considerably more sensitive to irradiation than is the cutaneous type, and (2) there is little difference in the different types as far as localization is concerned. Least sensitive to irradiation were the tumors of cutaneous type in the movable part of the tongue.

Certain oral conditions of dental interest, which may be a factor in the development of malignant lesions, were discussed by Ast.[25] From the

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22. Baxter, H.: Malignant Melanoma in the Colored Races: Report of a Case Originating in the Mouth, Canad. M. A. J. **41**:350-354 (Oct.) 1939.

23. Breuekmann, H.: Ueber Melanome der Mundschleimhaut, Dermat. Wchnschr. **110**:36-40 (Jan.) 1940.

24. Zwingli, F.: Haut- und Schleimhauttyp des Plattenepithelcarcinoms der oberen Luft- und Speisewege; ihre Beziehungen zur Strahlenempfindlichkeit, Ztschr. f. Krebsforsch. **49**:109-136, 1939.

25. Ast, D. B.: The Dentist's Responsibility in Oral Cancer, J. Am. Dent. A. **26**:2036-2039 (Dec.) 1939.

standpoint of producing chronic irritation, he considered badly decayed teeth, pyorrhea, malocclusion, faulty dental restorations, continued use of escharotics in the treatment of lesions of the soft tissues and the excessive use of tobacco as factors. He also included forms of cancer in the oral cavity associated with occupational habits. In his opinion this subject is of great importance from the standpoint of oral hygiene and of preventive dentistry. An educational program dealing with care of the mouth was suggested for school children as a means of prevention and control of oral malignant lesions.

Grant [26] discussed methods of section of nerves for the relief of pain caused by cancer of the mouth and pharynx. This article is of particular interest to the neurosurgeon.

A rather interesting study of the zoologic distribution of intraoral cancer was outlined by Martin and Holland.[27] They concluded that the incidence of cancer of the mouth and throat in animals, although impossible to determine exactly, is undoubtedly low, as compared to that in man. Such a relatively low frequency, they declared, may be due to a more natural mode of life and indicates that intraoral cancer in man is chiefly attributable to causative factors introduced by civilization and to which animals are not subject.

A most interesting article on the history of cancer of the tongue was presented by Martin.[28] He stated that this is almost the only form of intraoral cancer which is mentioned even vaguely in the early medical writings. In addition to describing the references made to this disease in the early writings, the author gave a rather detailed account of various therapeutic measures which have been employed.

In discussing cancer of the tongue, Cowan [29] stressed the following factors: 1. Operative intervention is indicated in all cases of precancerous lesions and suspected early lingual cancer. 2. An early, fully established cancer confined to the accessible portions of the tongue may be removed by surgical means in the absence of distant or bilateral metastasis, if the tumor is a fully differentiated cell type, provided the general condition of the patient warrants the surgical risk, and the expectancy of life, aside from the disease, justifies it. 3. In general, operation is an adjunct to irradiation methods for the treatment of lesions of the tongue. 4. Block dissection of the neck is indicated for fully differentiated carci-

26. Grant, F. C.: Relief of Pain in Cancer of the Tongue and Pharynx, Internat. Clin. **1**:169-173 (March) 1940.

27. Martin, H. E., and Holland, B. F.: The Zoologic Distribution of Intra-Oral Cancer, Scient. Monthly **49**:262-266 (Sept.) 1939.

28. Martin, H. E.: The History of Lingual Cancer, Am. J. Surg. **48**:703-716 (June) 1940.

29. Cowan, L. R.: Surgical Treatment of Cancer of the Tongue, Surg., Gynec. & Obst. **70**:543-551 (Feb.) 1940.

noma when the primary lesion is controlled or controllable, when the metastatic lesion is limited to one side of the neck and is in general confined within the capsule of the lymph node, when the position of the metastatic lesion permits the sacrifice of sufficient surrounding tissues to insure complete removal and when the patient is a good surgical risk and the expectant period of life otherwise warrants. 5. Bilateral block dissection of the neck may be advisable in carefully selected cases. 6. Block dissection, either unilateral or bilateral, is not indicated in the absence of metastasis. 7. Incomplete block dissections are responsible for many failures that otherwise might be successes in the hands of one trained in the practice rather than in the mere theory of this type of surgical procedure.

According to von Dollinger da Graça,[30] cancer of the anterior third of the tongue is best treated by electrocoagulation or, if the tumor is in the tip of the tongue, by means of the electric knife. However, for malignant lesions elsewhere on the tongue, he advocated the use of radium. Since he does not have access to radon, he is forced to use radium needles. Because needles are difficult to keep in the required position, the author developed the following method for retaining them in the desired location: A groove is made at the site of the growth by the electric knife. The radium, inserted in a platinum capsule, is placed in the groove and held in position by means of two or three sutures. This radium is kept in position for four to five days with little discomfort to the patient.

Touraine [31] discussed the case of a man aged 57 who had a slightly positive Wassermann reaction and an ulcer on the dorsum of the tongue. Although on microscopic examination the ulcer was thought to be an epithelioma, it also evidenced heavy plasma cell and lymphocytic infiltration of the underlying tissues. After six weeks of intensive antisyphilitic treatment, the lesion disappeared entirely, thus disproving the diagnosis of epithelioma.

In a general article on cancer of the tongue, Cade [32] outlined the following factors as important: 1. Cancer of the tongue is preceded by some precancerous condition in the majority of cases. Treatment of the precancerous condition is the real prophylaxis for cancer. 2. Early diagnosis is of utmost importance and can be obtained in all cases by biopsy. 3. Irradiation is the method of choice in treatment of primary

30. Von Dollinger da Graça: Malignant Tumors of the Tongue: A Modified Method of Treatment, Am. J. Roentgenol. **42**:890 (Dec.) 1939.

31. Touraine, M. A.: Régression d'un épithélioma de la langue sous la seule action du traitement antisyphilitique, Bull. Soc. franç. de dermat. et syph. **46**:888-891 (June 8) 1939.

32. Cade, S.: Cancer of the Tongue, Practitioner **143**:40-48 (July) 1939.

growths in the tongue; the procedure used depends on the site and extent of the lesion. 4. The cervical lymphatic region is involved sooner or later in 80 per cent of lingual cancers, and operation is still the best method of treatment of malignant growths in cervical glands.

Roux-Berger and Tailhefer [33] carried out an excellent study on the treatment of adenopathies in 494 cases of cancer of the tongue anterior to the sulcus terminalis, recorded at the Curie Foundation, Paris, France, between 1919 and 1933. In all cases the patients were traced five or more years. The cases were considered according to the following methods of treatment: (1) no treatment of lymph nodes; (2) early irradiation to the nodes; (3) both operation and irradiation and (4) cervical dissection only. These cases were again subdivided according to whether initial clinical evidence of adenopathy was present or absent. In the cases in which treatment was not applied to the lymph nodes five year cures were obtained in 10 per cent of those in which adenopathy was present and in 34 per cent of those in which it was absent. In cases in which radiation alone was given promptly, 19 per cent of cures was obtained, and in nearly all of these evidence of clinical adenopathy was doubtful or absent. Thirty-three per cent of cures were obtained in cases of surgical management of grossly involved nodes and 45 per cent of cures in cases of clinically uninvolved glands. Thus, the combined survival rate for all surgically treated patients was 38 per cent, and that for patients who had histologic invasion of the removed nodes was 9 per cent. In the fourth group, consisting almost entirely of cases in which extension to the neck was found on histologic examination, radiotherapy was employed after block dissection. Of these cases, clinically affected nodes were not apparent in 18 and cures were obtained in 4 (22 per cent); of 36 cases in which adenopathy was present, cure was obtained in 6 (10 per cent). By combining the last two series the authors showed the impossibility of diagnosing clinically the real state of the nodes, as they found microscopic invasion in 33 of 60 cases in which the lymph nodes had been considered normal by palpation.

A number of patients whose lymph nodes were treated five or more months after removal of the local lesion responded poorly to any treatment. No cures were obtained with radiation alone, and no significant value was attached to the use of radiation after operation.

Another interesting part of this study was concerned with the problem of crossed metastasis. Of 306 cases of a definitely unilateral primary lesion, in only 6 per cent was secondary extension to the opposite side present; whereas, it occurred in 32 per cent of 188 cases

33. Roux-Berger, J. L., and Tailhefer, A.: Cancer de la partie mobile de la langue; traitement des adénopathies, 494 cas, Mém. Acad. de chir. **65**:835-850 (June 7) 1939.

in which the lingual growth touched or passed the midline. Of the total series of cases, in 23 per cent there was lingual recurrence and in 47 per cent glandular recurrence; in many the two were concomitant. Struck by the frequency of inadequate eradication of the primary growth by radiation, Roux-Berger and Tailhefer subjected 40 patients who had local recurrence only to electrosurgery, gaining 10 cures. They suggested the advisability of more frequent use of the method. They concluded that at present, prompt, wide and radical block dissection is the treatment of choice for adenopathies from the tongue; in all cases in which the lesion is not clearly confined to one side of the tongue, the operation should be bilateral.

Sachs [34] reported on 147 cases of primary carcinoma of the tongue. Necropsy was performed in 41 of these; in 4, distant metastasis was present. Four additional cases gave roentgenologic evidence of distant metastasis, 2 to the lungs, 1 to the sternum and 1 to a vertebra. Consequently, the author expressed the opinion that if future treatment is to be considered seriously, whether it is operation or radium or roentgen therapy, or any combination of the three, for carcinoma of the tongue, it would be prudent to keep in mind the frequent possibility of distant metastasis.

A discussion of sublingual dermoids was presented by Bailey.[35] He outlined a method of diagnosis for the types of dermoids which occur above and below the mylohyoid muscles. As to treatment, the author concluded that the advantages offered by removal through an incision beneath the angle of the jaw are considerable. If the incision is made parallel to the mandible and ½ inch (1.3 cm.) beneath its lower border, the scar is inconspicuous. If the cyst is situated beneath the mylohyoid muscle, this muscle is divided and can be sutured afterward. There is a tendency for cysts above the mylohyoid muscle to be difficult to locate in the wound in the neck unless the anesthetist depresses the floor of the mouth. If the floor of the mouth is not opened, infection of the wound is obviated.

TUMORS OF THE NOSE

Hargett [36] declared that the only practical treatment of the fully developed nasal polyp is surgical removal. In summary, he recommended thorough shrinkage of the nose, detailed examination of the posterior half of the nasopharynx, determination of the etiologic factors in every case and elimination of the causative factor at the time of polypectomy.

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34. Sachs, M. D.: Metastases from Carcinoma of the Tongue, Am. J. Roentgenol. **42**:833-842 (Dec.) 1939.

35. Bailey, H.: Sublingual Dermoids, Brit. J. Surg. **27**:140-143 (July) 1939.

36. Hargett, E. R.: Diagnosis and Treatment of Nasal Polyp, Ohio State M. J. **36**:151-153 (Feb.) 1940.

An unusual case of an asthmatic youth aged 15 who had nasal polyps with external facial deformity was reported by Laff.[37] He stressed the symptom complex described in foreign literature, in which belief is expressed that the external nasal deformity occurs from the effect of gradual pressure of the polypoid masses on the developing sinal walls; the author stated that so-called necrosing ethmoiditis and congenital syphilis do not necessarily produce this deformity. Although nasal polyps are unusual in childhood, he stressed the importance of removing such polyps early in order to avoid subsequent facial deformity. It was suggested that the facial deformity might be improved by the usual intranasal rhinoplasty, although the cosmetic result depends on adequate control of the recurring polyps.

Five cases of bleeding nasal growths diagnosed as granuloma pyogenicum were reported by Frank and Blahd.[38] The lesions appeared clinically as typical bleeding polyps of the nasal fossa. The similarity of bleeding polyp and nasal pyogenic granuloma was discussed thoroughly. The authors stated that bleeding polyps should not be classified as fibrovascular tumors, even though their blood vessels present an angiomatous appearance and they do not reveal diffuse inflammatory infiltration. Apparently, the authors were of the opinion that the tumors were pyogenic granulomas. The identity of bleeding polyps of the nasal fossa with granuloma pyogenicum was demonstrated by comparison of the clinical and histologic characteristics of these lesions.

Fletcher[39] considered syphilis, leprosy, glanders, rhinoscleroma, infected foreign bodies and some forms of malignant or new growth essential in the differential diagnosis of sarcoid. Although sarcoid is a noncaseating form of tuberculosis, its identity rarely is proved by biopsy. Since healing occurred at the site of biopsy in all of the cases reported by Fletcher, it was concluded that excision is the treatment of choice.

Smith[40] reported 5 cases of osseous lesions involving the nose or sinuses. Histologically, the lesions in the first 2 cases contained simple, compact bone and gave a definite picture of tumor formation, that is, osteoma. In the third, fourth and fifth cases the growths appeared clinically to be osteomas, but on histologic study they could not be

37. Laff, H. I.: Case Report: Deforming and Recurring Polyps of Youth, Arch. Otolaryng. **30**:795-799 (Nov.) 1939.

38. Frank, I., and Blahd, M.: Pyogenic Granuloma of the Nasal Fossa, Arch. Otolaryng. **31**:919-924 (June) 1940.

39. Fletcher, R.: Chronic Nonhealing Lesions of the Nose, California & West. Med. **52**:62-64 (Feb.) 1940.

40. Smith, A. T.: Osseous Lesions of Nose and Sinuses, with Special Reference to Hypertrophic Changes and Tumor Formations, Arch. Otolaryng. **31**:289-312 (Feb.) 1940.

differentiated from hypertrophic lesions of bone, namely, those of the so-called fibrocystic group. The author stated that the lesions in these 3 cases were not necessarily true osteomas but might have taken on secondary neoplastic properties. He stated that these lesions might have begun primarily as another process, probably a reparative process in response to injury. A sixth case of typical giant cell tumor involving the right maxilla was reported in order to illustrate the similarity, gross and histologic, of this tumor and the osteoma in the fifth case. The author stated that hypertrophic changes and tumor formations in bony lesions of the nose and sinuses may present similar clinical features but that their pathologic interpretation is uncertain. Osteoma, as a true neoplasm, has not been distinguished clearly from other forms of overgrowth of bone, particularly the so-called fibrocystic group of lesions of bone. Because of the number of instances in which osteoma combines the clinical features and histologic characteristics of both giant cell tumor and osteitis fibrosa, the author concluded that these conditions may be closely allied and that the possibility of a common cause must be considered. Some sort of trauma seemed to be the most important etiologic factor. Smith stated that a better understanding of the etiologic factors may reveal that in the cases in which the lesion cannot be proved definitely to be a true neoplasm, radical surgical intervention, with its attendant deformity, is not necessary in an attempt to eliminate the condition.

In a brief review of the function of the laryngologist in relation to cancer of the nose and throat, King [41] emphasized the following points: (1) early diagnosis; (2) cooperation between radiologist and laryngologist; (3) surgical removal of intrinsic cancer of the larynx, and (4) employment of surgical intervention and irradiation in treatment of malignant disease of the nose and sinuses.

Colloid cancer of the nose is rare. Ofner [42] reported a case of such a neoplasm in order to demonstrate diagnostic difficulties and scarcity of clinical findings. The patient was a man aged 52 who complained of difficulty in breathing, pain and ringing in the right ear, headache, dizziness and difficulty in hearing. A diagnosis of sinusitis on the right side was made, although roentgenologic findings did not indicate this. Many neurologic symptoms developed later, and the patient died. At necropsy and on microscopic examination, cancer of the nose, which originated in the sphenoid cavity, was found; this tumor completely filled the right nasal passages, the right pterygopalatine fossa and the cranial cavity and penetrated into the brain.

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41. King, E.: Treatment of Cancer of the Nose and Throat, Ohio State M. J. **36**:627-628 (June) 1940.

42. Ofner, R.: Ein Fall von Gallertkrebs der Nase, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **146**:184-188, 1939.

Of interest was a report of a case by Margarot, Rimbaud and Ravoire.[43] A man aged 65 had a malignant melanoma at the completely healed site where a lead shot had lodged in the right ala of the nose several years previously. Extension, with numerous cutaneous metastatic growths accompanied by vague digestive complaints and fatigue, was evident within four weeks of recognition of the original lesion. The patient died five months later. At necropsy, extensive invasion of the skin, all serous membranes and the thoracic nodes was found. The authors concluded that the foreign body acted as an inciting agent for the growth and that the extension was almost entirely by the vascular route, although none of the visceral organs was involved.

Hollander and Shelton [44] developed a cone 1 cm. in outside diameter which can be inserted into the nasal cavity for roentgen therapy. They stated that ordinary cones are much too large to permit insertion into the nose.

TUMORS OF THE NASOPHARYNX

In addition to the reports of 3 cases, a discussion on vascular fibromas involving the nasopharynx was presented by Friedberg.[45] Since these tumors bleed readily and deaths from hemorrhage have been reported following their removal, the author was not in favor of surgical resection of the bony attachments of such tumors in the nose, palate or maxilla or avulsion of such a growth with a cold snare. He stressed the satisfactory results which can be obtained by the use of surgical diathermy and implantation of radium needles or radon seeds. In an analysis of the 3 cases reported, he asserted that changes in histologic structure were not observed in the first 2 tumors after irradiation. However, the author pointed out that in the third case the patient had reached an age after which involutional changes in the tumor might be expected to occur. Consequently, it is possible that irradiation was a factor in initiating retrogressive changes in this tumor, but this was not certain.

Curry and Friedberg [46] presented a detailed article on malignant tumors of the nasopharynx. This included data on carcinomas, sarcomas, malignant chordomas and craniopharyngiomas. Also considered were fibromas, which appear during adolescence and frequently

43. Margarot, J.; Rimbaud, P., and Ravoire, J.: Mélanome malin développé autour d'un corps étranger et suivi d'une généralisation immédiate, Bull. Assoc. franç. p. l'étude du cancer **28**:448-455 (March) 1939.

44. Hollander, L., and Shelton, J. M.: An Intranasal Cone for the Chaoul Apparatus, Am. J. Roentgenol. **43**:295 (Feb.) 1940.

45. Friedberg, S. A.: Vascular Fibroma of the Nasopharynx (Nasopharyngeal Fibroma), Arch. Otolaryng. **31**:313-326 (Feb.) 1940.

46. Curry, L. T., and Friedberg, S. A.: Diagnosis and Treatment of Malignancies of the Nasopharynx, S. Clin. North America **20**:153-161 (Feb.) 1940.

simulate malignant lesions, and the symptoms of nasopharyngeal malignant tumors. In the authors' opinion, the treatment of nasopharyngeal malignant disease is exclusively irradiation; its therapeutic effectiveness is directly proportional to the extent of the growth at the time of recognition. An early lesion without cervical metastasis, which may have been discovered by routine nasopharyngeal examination, offers the best possibility for permanent cure. Carcinoma and sarcoma of the nasopharynx are highly radiosensitive, and in most instances the primary growth will regress completely under treatment and the patient will later succumb to a distant metastatic lesion. Surgical intervention is contraindicated in the treatment of nasopharyngeal malignant disease. For vascular fibroma, irradiation and surgical diathermy are an effective combination. Roentgen rays and radium were considered equally effective therapeutic agents.

A case of carcinoma of the nasopharynx of a patient 65 years of age was reported by Druss.[47] The patient had been operated on for mastoiditis, and three months later signs of involvement of the petrous pyramid developed, which is the basis of interest in this report.

Potozky and Freid [48] discussed the case of a patient aged 60 who had nasopharyngeal lymphosarcoma treated by roentgen rays. During the course of roentgen therapy meningitis developed, which at necropsy was found to be due to osteomyelitis of the basilar portion of the occipital bone and not to extension of the tumor through the base of the skull. This was explained on the basis that the tumor underwent necrosis during treatment and that the infection reached the adjacent bone marrow, probably through perforated lymph vessels. The end result was fulminating osteomyelitis, with invasion of the blood stream. The meningitis was considered as sympathetic meningitis attributable to the presence of a contiguous, suppurative focus and not as bacterial meningitis.

A case of carcinoma of the nasopharynx of a man aged 49 was reported by Bach, Lederer and Palevsky.[49] The diagnosis was not made until late in the course of the disease because the tumor was not seen projecting into the nasopharynx. Although clinically the tumor appeared to originate in the right nasopharyngeal wall, at necropsy it

47. Druss, J. G.: Carcinoma of the Nasopharynx with Extension to the Petrous Pyramid: Report of Case, Laryngoscope **50**:359-365 (April) 1940.

48. Potozky, H., and Freid, J. R.: Osteomyelitis of Occipital Bone Complicating the Roentgen Treatment of a Nasopharyngeal Lymphosarcoma, Am. J. Roentgenol. **43**:584-586 (April) 1940.

49. Bach, A. C.; Lederer, F. L., and Palevsky, S. N.: Case Report: Nasopharyngeal Carcinoma; Extension Intracranially and Metastasis by Implantation into the Soft Palate; a Clinical and Pathologic Study, Arch. Otolaryng. **31**:529-539 (March) 1940.

was found that it actually originated in the left nasopharyngeal wall and had broken through into the skull. The authors stressed the importance of this case, since both clinical and pathologic points of view were presented. They expressed the belief that the publication of such combined observations would assist greatly early diagnosis and treatment of this lesion.

To facilitate careful examination of the nasopharynx, Zöllner [50] stressed the use of the endoscope. Particular reference was made to visualization in the region around the eustachian tubes and Rosenmüller's fossa, which is of special importance in the early diagnosis of nasopharyngeal neoplasms.

TUMORS OF THE PHARYNX AND HYPOPHARYNX

Stressing the poor results of radiotherapy for cancer of the pharynx and larynx at the Curie Institute, at which there was a 100 per cent failure in treatment of lesions of the piriform sinus, Aubry [51] discussed the value of operation for pharyngolaryngeal neoplasm. The lessened operative risk of his surgical technic he considered to be attributable chiefly to preliminary tracheotomy followed by wide lateral approach, enabling dissection of the whole posterior wall of the pharynx and larynx. After the pharynx was opened below the hyoid bone, the whole dissected mass was mobilized by a forceps, one blade of which was placed in the larynx and the other on the anterior angle of the thyroid cartilage; the surgeon was thus enabled to inspect and completely remove all of the involved pharynx. The edges of the skin were sutured carefully and three packs inserted. After two or three months, if the pharynx did not close spontaneously, plastic repair was carried out. This method was said to offer no greater risk than complete laryngectomy and to prolong feeding by tube only a week.

According to Martin,[52] the technic of fractionated roentgen irradiation in cases of pharyngeal cancer cannot be standardized to permit the use of one set of factors in treatment in all cases. Such factors as the size and shape of the skin portals, the size of the individual and total doses and the target-skin distance must be varied in order to suit each case, depending on the response of the tumor and the toleration of the patient. The exclusive use of roentgen irradiation alone is not the best method of treatment in all cases of pharyngeal cancer. By the use

50. Zöllner: Leistungen der Nasen- und Rachenendoskopien bei Entzündungen und Geschwülsten dieses Gebietes, Ztschr. f. Hals-, Nasen- u. Ohrenh. **46**:214-222, 1939.

51. Aubry, M.: Considérations sur le traitement chirurgical du cancer pharyngolaryngé, Ann. d'oto-laryng., November-December 1939, pp. 905-908.

52. Martin, H. E.: Variations in Radiation Technic and Biologic Effects in the Treatment of Pharyngeal Cancer, Radiology **34**:149-161 (Feb.) 1940.

of supplementary interstitial radon, many of the undesirable effects of heavy dosage by roentgen rays alone may be avoided. A radioresistant residuum or growth in an outlying node may often best be controlled by supplementary interstitial radon. Several other variations in the biologic effects following variations in the several physical factors of roentgen irradiation were considered in detail.

In a general discussion of the treatment of carcinoma of the larynx and pharynx, Truffert [53] advocated diagnostic roentgen therapy for growths of the laryngopharynx as an index of radiosensitivity and also as a means of sterilizing the operative field. If operation is indicated after this procedure has been carried out, radical laryngopharyngectomy should be performed. For carcinoma of the piriform sinus, the author presented as a compromise between the inefficacy of radiotherapy and the mutilation of a radical surgical procedure the procedure of exteriorization of the pharynx through a lateral incision, followed by interstitial irradiation four days later. Two patients treated by this method lived eight and twelve months, respectively; the carcinoma recurred in the base of the tongue.

TUMORS OF THE LARYNX

Delph [54] discussed benign laryngeal tumors, including papillomas, fibromas, adenomas, angiomas, pseudoangiomas, myxomas, chondromas, osteochondromas, cysts, inflammatory tumors, amyloid deposits and xanthomas, as well as hyperplasia and leukoplakia.

A case of chondroma of the larynx was reported by Equen and Neuffer.[55] In the treatment of this rare tumor, the authors recommended removal as soon as the diagnosis is determined.

In a preliminary investigation, Broyles [56] reported that the local application of an estrogenic substance (amniotin) seemed to have a definitely beneficial effect in the treatment of 5 children for multiple laryngeal papillomas.

Berendes [57] reported a case of an angiomatous tumor in the laryngeal region because he believed that it differed in certain respects from those previously reported in the literature. The patient was a child

53. Truffert, P.: Considérations sur l'abord chirurgical du cancer du laryngo-pharynx. L'extériorisation du pharynx, Paris méd. **1**:101-104 (March 2-9) 1940.

54. Delph, J. F.: Benign Tumors of the Larynx, Quart. Bull. Northwestern Univ. M. School **14**:26-30, 1940.

55. Equen, M., and Neuffer, F.: Chondroma of the Larynx Requiring Total Laryngectomy, South. M. J. **33**:274-279 (March) 1940.

56. Broyles, E. N.: Treatment of Laryngeal Papilloma in Children with Extrogenic Hormone: Preliminary Report, Bull. Johns Hopkins Hosp. **66**:319-322 (May) 1940.

57. Berendes, J.: Ueber ein infiltrierend wachsendes Hämangiom des Kehlkopfes, Arch. f. Ohren-, Nasen- u. Kehlkopfh. **146**:479-483 (Nov.) 1939.

5 months of age who had a large cavernous hemangioma on the inner aspect of the lower lip and a similar tumor in the region of the left arytenoid cartilage. The child died before galvanocaustic deep punctures into the tumor could be tried. At necropsy, it was found that the angioma extended into the inside of the larynx up to the mucous membrane and from the entrance of the larynx into the trachea on both sides of the cartilaginous framework and that it completely enclosed the inner laryngeal muscles. In addition to occupying space, the tumor had penetrated into the tissue itself, and there was a genuine infiltrating growth unlike most benign tumors. The tumor had penetrated the nerve sheaths but not the cartilage or perichondrium. The histologic picture was partly that of a proliferating hemangioma simplex hyperplasticum and partly that of a cavernous angioma. Cells also were found in the latter which revealed a form similar to those of a sarcoma.

We [58] described 3 cases of congenital cyst of the larynx encountered at the Mayo Clinic and reported 1 in detail. We stated that congenital laryngeal cysts arise from displaced embryonal cells which take part in forming the appendix of the ventricle. The treatment of such cysts depends on their size and location. If they cause laryngeal obstruction, surgical removal may require preliminary tracheotomy. In the case described in detail, the growth was removed through a laryngofissure incision, the right lamina of the thyroid cartilage being divided about 2 cm. to the right of the junction of the two thyroid laminas. The cyst was then shelled out without injury to the laryngeal mucosa, and the patient made an uneventful recovery.

Citing evidence for the chronic inflammatory causation of recurring laryngeal polyps, Coulet [59] presented the case of a 45 year old man who was examined periodically for thirteen years. Polyps were removed on seven occasions; at the last examination, active laryngeal and bilateral pulmonary tuberculosis, with evidence of old thoracic lesions, was discovered. After a year of treatment in a sanatorium, the infection of the lung was arrested and the sputum was negative for the tubercle bacillus, although signs of laryngeal activity were still present. Coulet stressed the fact that in all cases of recurring laryngeal polyps the possibility of underlying infection with an acid-fast organism should be ruled out by biopsy, roentgenograms of the thorax, examination of sputum and inoculation of guinea pigs, as well as by clinical search for involvement of lymph nodes and bone.

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58. New, G. B., and Erich, J. B.: Congenital Cysts of the Larynx: Report of a Case, Arch. Otolaryng. **30**:943-949 (Dec.) 1939.

59. Coulet, G.: Polypes du larynx et tuberculose, Ann. d'oto-laryng., July 1939, pp. 672-674.

Although Leborgne [60] pointed out the importance of tomography, he stated that it does not supplant lateral roentgenography or laryngoscopy. All three types of examination are necessary for a complete study of a laryngeal neoplasm and in making an accurate diagnosis. The author described the importance of tomography in cases of laryngocele, and he was able to distinguish this condition from laryngeal tumor. In conclusion, he discussed the interpretation of laryngeal tomographs and some points in technic in obtaining satisfactory ones.

In discussing surgical treatment of carcinoma of the larynx, Marschik [61] advised the use of conservative methods whenever possible. Endolaryngeal methods, laryngofissure, hemilaryngectomy and laryngectomy were discussed. In addition to carrying out preliminary tracheotomy in most cases, the author recommended postoperative irradiation (after the method of Coutard) in cases in which the lesion is extensive and extralaryngeal involvement is suspected. Marschik stated that there is too much competition between defenders of surgical intervention on one side and irradiation on the other. However, he did not present any statistics.

McCready [62] presented a general article on the surgical treatment of cancer of the larynx. He stressed the recognition of early symptoms and the importance of early treatment and emphasized the value of roentgenographic examination in order to determine the extent of the laryngeal tumor and to reveal unsuspected metastasis. It was his opinion that in all cases of intrinsic cancer of the larynx, surgical intervention was the treatment of choice, whereas irradiation was indicated in all cases of extrinsic cancer. He advocated operation supplemented by irradiation in the treatment of benign neoplasms in order to arrest the growth on the vocal cord before it becomes cancerous. In his opinion laryngofissure is the ideal method of treatment when the neoplasm is small and restricted to one cord. Laryngectomy was recommended for (1) cancer of one cord in which the cord is fixed, (2) lesions of one cord which cross the anterior commissure, (3) involvement of both cords, (4) subglottic cancer and (5) lesions which involve not only both vocal cords but the ventricles of the larynx.

Bumgardner [63] stated that carcinoma of the larynx comprises 2 per cent of all malignant lesions of the body and that in 80 to 85 per cent

60. Leborgne, F. E.: Tomography and Cancer of the Larynx, Arch. Otolaryng. **31**:419-425 (March) 1940.

61. Marschik, H.: Der gegenwärtige Stand in der Chirurgie des Kehlkopfcarcinoms, Ztschr. f. Krebsforsch. **49**:250-274, 1939.

62. McCready, J. H.: Surgical Treatment of Cancer of the Larynx, Radiology **34**:146-148 (Feb.) 1940.

63. Bumgardner, J. S.: Cancer of the Larynx as a Medical Problem, Kentucky M. J. **38**:88-90 (Feb.) 1940.

of cases laryngeal cancer is curable. Citing reports from the literature, he said that operation in selected cases results in cure in 80 to 85 per cent of cases, while roentgen therapy alone results in cure in about 35 per cent of the cases.

Brünings [64] described a new plastic procedure for maintenance of the airway of patients who had had previous hemilaryngectomy. He used a spiral device made of sterling silver, which connected the pharynx with the trachea. After operation, the patient is kept quiet in bed and fed by a nasal tube for four to six days. The patient is also given iodides in order to keep the secretions liquid and thereby prevent their adherence to the spiral. The spiral is kept in place for two to four weeks and is then removed through the mouth. Fourteen patients were treated in this manner, with good results. The plastic procedure was undertaken about six months to a year after removal of the neoplasm, in order to guard against possible recurrence.

Roentgen therapy was suggested by Schinz [65] as the treatment of choice for carcinoma of the vocal cords because of the rather high operative risk in cases of this neoplasm and because of the better functional result obtained by irradiation. The results of roentgen treatment in 39 cases, observed from 1929 to 1937, were as follows:

No. of Patients Treated	Survival After Treatment, Yr.	No. of Patients Living	Percentage of Patients Living
39	1	22	56
36	2	12	33
33	3	10	30
24	5	6	25

Since all cases were included, even those in which the lesions recurred after operation, the author considered that these results were good.

Coutard [66] described the results of roentgen therapy at the Curie Hospital from 1921 to 1932. This report included data for 142 patients who had cancer of the larynx. Of these, 27 per cent survived five years without symptoms, and 22 per cent, ten years without symptoms. The fact that undifferentiated forms disappeared with extreme rapidity whereas the differentiated form required three to four months for its disappearance was discussed fully. However, the dose of roentgen rays required was about the same in either instance; the method and the time of distribution were the only factors changed. Also considered was the

64. Brünings: Eine neue Wiederherstellungsoperation (Plastik) nach partieller Kehlkopfexstirpation, Ztschr. f. Krebsforsch. **49**:278-286, 1939.

65. Schinz, H. R.: Der Stimmbandkrebs, Strahlentherapie **66**:203-218, 1939.

66. Coutard, H.: Present Conception of the Treatment of Cancer of the Larynx, Radiology **34**:136-145 (Feb.) 1940.

use of high voltage rays, which has simplified the method of roentgen therapy. This simplification, Coutard stated, was accomplished by the use of a single field, with a regular and daily decrease in the surface area and with a regular and daily increase in the dose. Needless to say, the use of this technic requires precision of treatment.

According to Sellers,[67] the use of radiation therapy in the management of laryngeal carcinoma is having an increasingly wider application. Since the advent of the Coutard method of fractional dosage, with its modification, he stated that no longer is excessive destruction of cartilage feared. In all cases in which respiration is embarrassed tracheotomy was advised before radiation therapy was instituted. The tube was retained until the reaction had subsided completely.

Levin [68] asserted that, with the exception of carcinoma of the cervix, no carcinoma shows so clearly the superiority of radiotherapy over surgical operation as does laryngeal carcinoma. It was the author's opinion that further improvement in the therapeutic results depended on early recognition of the disease by the general practitioner.

Pack and Campbell [69] presented a most interesting historical account concerning Frederick III, of Germany, who died of a laryngeal carcinoma.

TUMORS OF THE TRACHEA

One case of cylindroma of the trachea was reported by Boemke and Moritz.[70] In the course of four years, first unilateral and then gradually bilateral palsy of the vocal cords developed, with much obstruction of the breathing. This unilateral paralysis of the recurrent nerve, extending gradually to involve the other side, is considered as a syndrome in cases of peritracheal neoplasm located high on the trachea. The histogenesis of the cylindroma was discussed at length. It was considered to be an epithelial tumor, which almost always is benign but occasionally is able to infiltrate the tissue and even to metastasize.

Sixteen cases of carcinoma of the trachea encountered at the Mayo Clinic from 1921 to 1937 were reported by Olsen.[71] In an attempt to correlate the pathologic, clinical and therapeutic aspects of this con-

67. Sellers, L. M.: The Clinical Management of Laryngeal Carcinoma, Texas State J. Med. **35**:627-629 (Jan.) 1940.

68. Levin, I.: Technique of Radium Therapy in Carcinoma of Larynx, Mississippi Valley M. J. **62**:50-53 (March) 1940.

69. Pack, G. T., and Campbell, R.: Historical Case Records of Cancer: The Laryngeal Cancer of Frederick III of Germany, Ann. M. Hist. **2**:151-170 (March) 1940.

70. Boemke, F., and Moritz, W.: Beitrag zur Kenntnis der Cylindrome der Luftröhre, Ztschr. f. Hals-, Nasen- u. Ohrenh. **45**:228-241, 1939.

71. Olsen, A. M.: Carcinoma of the Trachea, Arch. Otolaryng. **30**:615-630 (Oct.) 1939.

dition, the following points were emphasized: 1. The diagnosis of tracheal carcinoma is made most readily by means of bronchoscopic examination. This procedure should be carried out in any instance in which obstruction of the upper air passages is not explained or in which there is no obvious reason for hoarseness of the patient or for paralysis of the vocal cords. 2. Specimens for biopsy should be taken from the tumor. It is important to determine whether the carcinoma is glandular or squamous cell in type. The degree of malignancy of the tumor should be estimated. 3. The relative malignancy of a carcinoma may be ascertained by grading the tumor according to the method of Broders. The classification of carcinomas into four grades is made on the basis of the ratio of differentiated to undifferentiated cells. 4. Although the prognosis for carcinoma of the trachea is admittedly poor, there are occasions when accessible tumors of the glandular cell type of a low grade of malignancy are amenable to treatment. 5. Local removal and cauterization combined with surgical diathermy appear to be the most efficacious methods of treatment. These procedures may be carried out through the bronchoscope or through a tracheotomy wound. 6. Surgical resection of the trachea is the treatment of choice when squamous cell tumors or tumors of a high grade of malignancy are encountered.

Treatment with roentgen rays or implantation of radon seeds may be of definite value in some instances. Seven of the 16 patients were living and well for nine months to nine and a half years after treatment. In 2 of 9 other cases the patients were in a hopeless condition when first seen at the clinic; in 1 case, the tumor had metastasized to the left frontal region. The efficacy of treatment was considered inversely proportional to the grade of malignancy of the tumor, that is, a growth of grade 1 was most amenable and one of grade 4 least amenable. Five of the 8 patients treated successfully had adenocarcinoma of grade 1.

Miller [72] presented a case of primary carcinoma of the trachea in a man aged 65. This case was reported because of the extreme rarity of such a lesion, as only 147 cases had been reported in the literature up to June 1936. This patient complained of a tickling sensation in the throat and hoarseness as initial symptoms. Bronchoscopic examination was considered the most important method of diagnosis, although laryngoscopic and roentgenographic examinations also were carried out. The patient died six months after the symptoms first appeared. The author stressed the use of bronchoscopic examination as an aid to early diagnosis of this disorder.

Weinberg [73] reported 2 cases of sarcoma of the trachea. One case was that of a man aged 50; the tumor was reported histologically as a

72. Miller, I.: Primary Carcinoma of the Trachea, Arch. Otolaryng. **31**:675-679 (April) 1940.

73. Weinberg, T.: Sarcoma of the Trachea: Report of Two Cases, Am. J. Cancer **37**:201-208 (Oct.) 1939.

myxosarcoma. The second case was that of a man aged 34; the tumor was reported as a spindle cell sarcoma. The author stated that tracheal sarcoma grows slowly and may be present for many years before discovery. As this tumor is of a relatively low degree of malignancy, death usually is produced by mechanical effects on the respiratory system, which induce chronic anoxemia and subsequent cardiac failure. The majority of sarcomas reported are spindle cell in type and usually arise in the upper portion of the trachea, either in the posterior or the lateral wall. Weinberg stated that the slow growth of these tumors might be explained partly on the basis of the histologic structure and partly on the basis of development from an originally benign fibroma.

TUMORS OF THE ESOPHAGUS

During a recent five year period, 102 patients who had esophageal tumor were observed by Finger.[74] The ratio of men to women in this series was 4:1; in other reports, men have far outnumbered women. Comparing his statistics with those of former years, the author found a definite trend toward occurrence of esophageal tumor in the older age groups. The end result of treatment of these patients was not given. The position of the carcinomas in the esophagus in this series was essentially the same as that described in earlier works, namely, cervical, 14 per cent; sternal, 45 per cent, and in the lower third of the esophagus, 41 per cent. During this five year period of observation, only 1 benign esophageal tumor was observed.

Glynn[75] reported a case of a large pedunculated fibroma of the esophagus. Esophagoscopy and gastrostomy were performed, but the patient died.

According to Gillies,[76] carcinoma may involve the esophagus at any level. In the differential diagosis of carcinoma of the esophagus by roentgenographic studies, chemical stricture, cardiospasm and an opaque foreign body are the only alternatives to be considered. Usually, the presence of carcinoma in the esophagus is detected easily. Gillies stated that irradiation offers little in treatment of carcinoma of the lungs and esophagus.

Vinson[77] considered the following facts in regard to carcinoma of the esophagus: 1. Cure of carcinoma of the esophagus seldom is accom-

74. Finger, H.: Ueber die Geschwülste der Speiseröhre, München. med. Wchnschr. **86**:1640-1642 (Nov. 17) 1939.

75. Glynn, L. E.: Large Pedunculated Fibroma of Oesophagus, Brit. J. Surg. **27**:610-615 (Jan.) 1940.

76. Gillies, C. L.: The X-Ray Diagnosis of Carcinoma of the Esophagus, J. Iowa M. Soc. **30**:201 (May) 1940.

77. Vinson, P. P.: The Palliative Treatment of Carcinoma of the Esophagus, Virginia M. Monthly **67**:144-146 (March) 1940.

plished. 2. Gastrostomy is attended with a high operative risk, does not prolong life and rarely increases comfort. 3. Few beneficial results have followed treatment of carcinoma of the esophagus by irradiation. However, the author emphasized the use of silk thread swallowed as a guide for passing sounds or tubes through a malignant stricture in the esophagus; this not only simplifies instrumentation but provides the greatest degree of palliation with minimal risk.

Since the onset of carcinoma of the esophagus is insidious, the symptoms occur late and physical examination is of little help. Moersch [78] stated that the diagnosis depends largely on roentgenographic studies and esophagoscopy. Invariably, carcinoma of the esophagus is of a high grade of malignancy. In the author's opinion it is only in exceptional cases that surgical intervention offers a possible successful termination and the present status of radiotherapy in the treatment of carcinoma of the esophagus is in a state of much uncertainty. In most cases the condition has advanced to such a degree that any treatment is primarily palliative. However, the development of scar after destruction of cancer by surgical diathermy retards the malignant growth. Clinically, a definite improvement will be noted in the patient's condition after the use of surgical diathermy. In fact, improvement is out of proportion to the amount of growth destroyed.

Schattenberg and Ziskind [79] reported a case of carcinoma of the esophagus with perforation into the aorta.

A case of carcinoma in which a segment of esophagus was removed was recorded at the Massachusetts General Hospital, Boston.[80] At the time the article was written, the patient had recovered from the operation and was waiting for reconstruction of a new esophagus.

Petersen [81] considered neoplasms which involved the lungs or esophagus to be in a fashion similar to neoplasms within the abdominal cavity. That is, unless the lesions obviously are inoperable the patient should be subjected to an exploratory operation, with radical resection if possible.

As outlined by Kaiser,[82] three kinds of irradiation can be used for cancer of the esophagus: (1) roentgen irradiation alone; (2) radium irradiation alone, or (3) combined roentgen and radium irradiation.

78. Moersch, H. J.: Surgical Diathermy in the Treatment of Carcinoma of the Esophagus, S. Clin. North America **19**:1003-1010 (Aug.) 1939.

79. Schattenberg, H. J., and Ziskind, J.: Carcinoma of Esophagus Perforating the Aorta, Am. J. Clin. Path. **19**:615-621 (Nov.) 1939.

80. Epidermoid Carcinoma of the Esophagus, Grade II, Cabot Case 25262, New England J. Med. **220**:1085-1086 (June 29) 1939.

81. Petersen, V. W.: Carcinoma of the Esophagus, J. Iowa M. Soc. **30**:203-205 (May) 1940.

82. Kaiser, R.: Beitrag zur Frage der Röntgenbestrahlung des Speiseröhrenkrebses, Beitr. z. klin. Chir. **170**:432-437, 1939.

Two cases of severe carcinoma of the esophagus in which roentgen radiation alone was used in simple fractional daily doses were reported. One patient was a man aged 57 who had esophageal carcinoma and almost complete obstruction. The patient was given radiation treatment with outstanding success. Ten weeks after the beginning of treament, the patient could swallow all types of food particles and a roentgenogram revealed that the esophagus was almost completely normal. Five months after the beginning of treatment, the patient returned to work, had gained weight and was feeling well. The second patient was a woman aged 68 who had an extensive carcinoma of the lower third of the esophagus. Nine weeks after treatment with radiation was begun, roentgenograms revealed complete disappearance of the growth. The patient gained in weight and felt well. These patients have not been observed for a sufficient length of time to be considered permanently cured; however, these cases were reported as an encouragement for the roentgenologic treatment of cancer of the esophagus in similar cases which seem hopeless.

Dormanns [83] discussed 1,439 cases of carcinoma of the esophagus, compiled from the records of thirty-nine pathologic institutes in Germany (1925 to 1933). The tumors occurred most frequently among men in the seventh decade of life and did not seem to metastasize early. In one fifth of the cases, there was no evidence of metastasis or perforation. Of the tumors, 14.2 per cent were located high on the esophagus, 46.5 per cent were located at the level of the bifurcation of the trachea and 31.3 per cent were located at the cardia. In regard to adequate treatment, the author declared that nothing much can be done for patients with such growths as far as permanent cure is concerned. Early diagnosis and treatment in larger centralized institutions in order to accumulate experience in only a few hands was stressed.

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83. Dormanns, E.: Das Oesophaguscarcinom; Ergebnisse der unter Mitarbeit von 39 pathologischen Instituten Deutschlands durchgeführten Erhebung über das Oesophaguscarcinom (1925-33), Ztschr. f. Krebsforsch. **49**:86-108, 1939.

News and Comment

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Officers Elected.—Dr. James A. Babbitt, emeritus professor of clinical otolaryngology at the University of Pennsylvania School of Medicine and associate professor of otolaryngology in the university's graduate school of medicine, was named president-elect of the American Academy of Ophthalmology and Otolaryngology at its annual meeting, held in Chicago October 19 to 23. Dr. Babbitt will take office Jan. 1, 1943. The present president-elect is Dr. Ralph I. Lloyd, Brooklyn, who will assume office Jan. 1, 1942.

The vice presidents elected are Drs. Walter Theobald, Chicago; Forrest J. Pinkerton, Honolulu, Hawaii, and Francis E. LeJeune, New Orleans. Dr. Secord H. Large, Cleveland, was reelected comptroller and Dr. William P. Wherry, Omaha, executive secretary-treasurer.

Born in Vermont in 1869, Dr. Babbitt graduated from the University of Pennsylvania School of Medicine in 1898. Besides his professorships at his alma mater, he has served on the staff of the Children's Hospital of the Mary J. Drexel Home and as consultant to Lankenau, Children's, Misericordia and Mercy-Fitzgerald hospitals, in Philadelphia. During World War I he served in France and in Germany with the American Red Cross.

Dr. Babbitt is president of the American Laryngological, Rhinological and Otological Society and in 1939 was president of the American Laryngological Association. He is also a member of the American Otological Society, the American College of Surgeons, the American Medical Association and various Philadelphia organizations. Since 1939 he has been a member of the editorial board of the *Archives of Otolaryngology.*

Awards for Scientific Exhibits.—The awards for the best scientific exhibits, announced October 23, were made in three classifications. For excellence of presentation, Dr. Phillips Thygeson, Presbyterian Hospital, New York, received the award in ophthalmology for his exhibit on infections of the eye and their treatment with sulfanilamide and its derivatives, and Dr. Maurice F. Snitman, University of Illinois College of Medicine, Chicago, the award in otolaryngology for his exhibit on the anatomy of the ear, nose and throat.

The second classification was originality. The award for ophthalmology went jointly to Drs. J. Goldsmith and Henry Minsky, Mount Sinai Hospital, New York, for their presentations on cataract extraction and a method of studying the inner structures of the eye. In the section on the ear, nose and throat the award went to Dr. Paul Holinger, University of Illinois College of Medicine, Chicago, for his work on a new method of photographing the lower part of the respiratory tract, the tracheobronchial tree and the esophagus.

The third group of exhibits were those judged for their teaching value. An award was given to Dr. Peter Kronfeld, Illinois Eye and Ear Infirmary, Chicago, for his studies of tension within the eye and to Dr. Henry B. Orton, Newark, N. J., for an exhibit on cancer of the larynx.

Special mention was given to Philip F. Swindle, Ph.D., Milwaukee, for an exhibit on the blood vessels in the nose and eyes; to Dr. Henry Hilgartner, Austin, Texas, for kodachrome photographs of the background of the eye and the exterior of the eye, and to Drs. Gordon New and John Erich, Rochester, Minn., for demonstrations showing repair of facial injuries.

Specialists Honored.—Dr. Samuel J. Kopetzky and Dr. Conrad Berens, New York, and Dr. Jonas S. Friedenwald, Baltimore, were elected members of the Honor Society of the American Academy of Ophthalmology and Otolaryngology. Dr. L. W. Dean became a member of the Honor Society ex officio. The announcement was made at the annual banquet, held at the Palmer House.

The Honor Society was founded by the academy in 1939 as a tribute to its living past presidents. Now the members may elect to membership by secret ballot any of their colleagues who have given distinguished service to the organization and to the two specialties represented. The society acts as an advisory group to the academy's governing council.

Dr. Kopetzky, president of the Medical Society of the State of New York and director of the medical division of the Selective Service System of the New York city area, has long been active in the field of otolaryngology and in medical organization. He graduated from Columbia University College of Physicians and Surgeons, New York, in 1898 and became an instructor in diseases of the ear at the New York Post-Graduate Medical School and Hospital in 1905. He has been for a number of years professor of otology, New York Polyclinic Medical School and Hospital, and since 1939 has been director of the department of otolaryngology at that school. He is also director of otolaryngology at Israel-Zion Hospital, Brooklyn, and consulting otolaryngologist to the following hospitals: Beth Israel Hospital, New York; Nyack Hospital, Nyack, N. Y.; Newark Beth Israel Hospital, Newark, N. J.; Vassar Brothers Hospital, Poughkeepsie, N. Y., and Jamaica Hospital, Jamaica, L. I., N. Y. Besides the academy, Dr. Kopetzky is a member of the New York Academy of Medicine, the American College of Surgeons and the American Laryngological, Rhinological and Otological Society, of which he was president in 1938, and he has been a member of the House of Delegates of the American Medical Association for many years. He has served in many official capacities in the New York county and state medical societies, is editor of *New York Medical Week* and was for several years on the editorial staff of the *New York State Journal of Medicine* as literary chairman. He served in the United States Army during the Spanish-American War and in the medical corps in World War I, reaching the rank of colonel. He served in France with the 81st Division and was cited for gallantry.

Dr. Berens, who graduated from the University of Pennsylvania School of Medicine, Philadelphia, in 1911, is associate professor of ophthalmology at New York University College of Medicine and chairman of the American Board of Ophthalmology. He is executive secretary for North America of the recently organized Pan-American Congress of Ophthalmology and served as a member of the organizing committee. He is director of research at the New York Eye and Ear Infirmary, directing surgeon and pathologist of the Lighthouse Eye Clinic of the New York Association for the Blind, directing ophthalmologist of the Midtown Hospital and directing surgeon of the Seamen's Church Institute. At various times he has served on the staffs of St. Luke's Hospital, the New York Infirmary for Women and Children and Veterans' Administration Facility No. 81 and as a member of an advisory committee to the Associated Hospital Service

of New York. He is the editor of a standard textbook on diseases of the eye and has devised various instruments used in the treatment of these conditions. Among professional societies of which he is a member, in addition to the academy, are the American College of Surgeons, the American Ophthalmological Society and the New York Society of Clinical Ophthalmology. During World War I he served in France.

Dr. Friedenwald has been associate professor of ophthalmology at Johns Hopkins University School of Medicine and visiting ophthalmologist to Johns Hopkins Hospital since 1931. He took his medical degree at Johns Hopkins in 1920 and was appointed an instructor in 1923. He is ophthalmic surgeon to Baltimore Eye, Ear and Throat Charity, Union Memorial, Sinai and Provident hospitals. He is the author of a book entitled "Pathology of the Eye" and a frequent contributor to professional journals. In 1935 the Section on Ophthalmology of the American Medical Association awarded him the Lucien Howe Medal for research. Professional societies of which Dr. Friedenwald is a member include, in addition to the academy and the American Medical Association, the American Ophthalmological Society, the American Society for Clinical Investigation and the Ophthalmological Society of the United Kingdom.

Abstracts from Current Literature

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THE CONNECTION BETWEEN THE VEGETATIVE NERVOUS SYSTEM AND THE VESTIBULAR APPARATUS. K. ARSLAN, Riv. di clin. med. (supp. Margin. otolaryng.) **1**:1, 1940.

EFFECTS OF STIMULATION OF THE VESTIBULAR APPARATUS

Vestibulovascular Reflexes.—(*a*) Arterial Pressure: In 1905 Finkelburg demonstrated by experiments on human subjects that during an attack of vertigo from vestibular stimulation there was a variation of arterial blood pressure. Bilancioni noted a tendency to hypertension with rotary stimulation, while Wotzilka, in 1924, noted that there may be two varieties of blood pressure—one, hypertension, followed by hypotension; the other, hypotension from the start.

In 1934 Pick obtained a negligible increase or decrease in blood pressure after caloric and rotary stimulation. Some authors, notably Demetriades and Spiegel, Stein and Benesi, and De Crinis and Unterberger, have stated the belief that psychic reactions play a part in labyrinthine stimulation.

In 1938 Rosselli Del Turco stimulated not only normal persons but those with hypertension who did not have myocardial changes and found for the most part a minor lowering of blood pressure.

Various authors experimenting with animals failed to note any change either way. In 1932 Jongleod and Noyoon obtained well marked hypotension and bradycardia by stimulating animals by rotation.

In 1936 Bozzi and Ciurlo found that irrigation of the bulla with hot or cold water in narcotized dogs gave an increase of blood pressure.

(*b*) Volume of the Spleen: In 1936 Bozzi and Ciurlo established that splenic volume in narcotized dogs changes after irrigations with hot and cold water on the bulla. They used the oncograph to measure the spleen. They found that splenic constriction was not dependent on variations in respiratory rate or on reflex hypertension but on reflex adrenal emptying. Section of the eighth cranial nerve intracranially abolished this phenomenon.

(*c*) Endocranial Circulation: In 1922 Spiegel and Demetriades tested the variation in pressure of the intracranial fluid in rabbits, following stimulation with heat. After establishing that hypotension of labyrinthine origin was present even in decerebrate animals—thus eliminating the dependence of hypotension on vertigo—the authors demonstrated that heat stimulation led to a fall of pressure of the fluid and a corresponding contraction of the cerebral vessels, established by the plethysmograph of the cerebral mass.

(*d*) Plethysmographic Variations of the Arteries: Since vasomotor reactions cause changes in blood pressure, it is necessary to explore the behavior of the peripheral circulation. Viale, in 1925, and Allers and Leidler, in 1924, using heat stimulation, failed to get variations regularly with the plethysmograph.

In 1924 Maestranzi, using heat, elicited a primary vasoconstriction followed by vasodilatation. He felt that the primary reaction was possibly due to stimulation of the sensitive terminals in the external ear. In 1928 Fischer stated the belief that many extravestibular factors enter into the final determination of the findings.

De Crinis and Unterberger expressed the belief that heat stimulation in man produces two reactions: (1) vasoconstriction, which is psychic, and (2) vasodilatation, which is had when the nystagmus from heat comes on. Heat stimulation in the affected ear of a person with one or two unexcitable labyrinths gives a reaction of only the first phase.

In 1938 Rosselli Del Turco, after stimulating the labyrinth with heat or galvanism, observed with the plethysmograph a vasomotor action of vasodilatation preceded by a minor vasoconstriction. After stimulating an ear of a person who had an unexcitable labyrinth, he elicited vasoconstriction only. In persons who had hypertension without myocardial change, he did not elicit the same reaction as in normal persons; he elicited only vasoconstriction, which was drawn out.

(*e*) According to Marinesco (1930), Draganesco, Kreindler and Bruch (1930) and Patroni (1935), the capillary circulation under the nails showed a contraction, followed by vasodilatation.

(*f*) Retinal Vessels: In 1927 Zanni found vasoconstriction in man and animals after rotary, thermic and galvanic stimulation.

Worms and Charms, in 1931, and Demetriades, in 1928, also noted constriction of the venous channels associated with heat stimulation.

Vestibulocardiac Reactions (Reflexes).—(*a*) In Man: In 1920 Bilancioni found that rotary stimulation increases the frequency of the pulse rate; according to Viale, in 1923, heat accelerates the cardiac rate.

In 1936 Galamini noted that after an initial increase there was a decrease in the number of heart beats, followed by a terminal increase. In 1934 Pick failed to notice any definite change after thermal or rotary stimulation.

In 1934 Ciurlo and Santucci demonstrated that rotary stimulation generally accelerated the cardiac rate, while heat stimulation decreased it. In 1934 Pick, using the electrocardiograph, noticed short and occasional variations after thermal stimulation but did not exclude a vestibulocardiac reflex even though it was weak and difficult to trace on the electrocardiograph.

In 1937 Dalla Torre and Cantale, after much experimental work with heat stimulation, came to the conclusion that electrocardiographic changes of pure labyrinthine origin were rare.

In 1938 Del Turco found that heat and galvanism caused an increase in the pulse rate in the majority of persons who had hypertension without myocardial degeneration. Rarely was there no effect and never a diminution.

(*b*) In Animals: In 1926 Spiegel and Rothberger failed to note any change in the pulse rate of cats and rabbits after stimulation, while they noticed an increase in the rate in morphinized dogs, a phenomenon which disappeared after decerebration and which they interpreted as of cortical, not of labyrinthine, origin.

Vestibulorespiratory Reflexes.—(*a*) Rotary: In 1920 Bilancioni noted an increase in respiratory rate.

(*b*) Caloric: In 1924 Allers and Leidler noticed a shortening of inspiration and a lengthening of expiration, which were not proportionate to the nystagmus or synchronous with the vertigo. Other observers obtained the same results.

(*c*) In Animals: Spiegel and Demetriades, experimenting with dogs, cats and rabbits, demonstrated that the vestibular apparatus has an influence on the bronchial smooth muscle generally.

Vestibulogastroenteric Reflexes.—In 1921 Roccavilla, using galvanic stimulation, noted an increase in peristalsis and often antiperistalsis.

In 1931 Lebenson got experimental results which seemed to indicate a paralysis of gastric function causing antiperistalsis.

In 1924 Spiegel and Demetriades, using heat stimulation on rabbits, noted motor intestinal reactions of two phases: (1) from stimulation of the sensitive terminals in the external and middle ears and (2) of vestibular origin.

Vestibular Reactions on the Vegetative Nervous System.—In 1931 K. Arslan and others, after using heat, rotary and galvanic stimulation, observed: (*a*) a period of miosis, inconstant and fugitive; (*b*) a period of mydriasis, constant, and (*c*) a period of hippus.

In 1938 Zanzucchi confirmed the occurrence of a vestibulopupillary reflex in pigeons. He obtained the three phases whether he used heat or cold stimulation in the external auditory canal or applied the stimuli directly on the exposed semicircular canals. Surgical destruction of the ampulla or utricle abolished the reactions.

In 1939 Gatteschi and Rodolfo Masera, after tests on human subjects, in which they used heat and rotary stimulation, concluded that these stimuli did not exert an appreciable influence on the concentration of sugar in the blood; the same was true for bilirubin.

In 1936 Galamini, using heat stimulation, noted a reduction in the consumption of oxygen. Tests made on animals gave controversial results.

In 1933 Iwamoto, working with pigeons, noted a fall in body temperature after vestibular stimulation.

In 1939, Concetti and R. Masera, working with normal and pregnant pigeons, found that rotary and thermic stimulation increased the tonicity of the uterus in normal pigeons and caused an increase in the frequency of contraction of the uterus, while in the pregnant uterus no contractions were noted even after mechanical stimulation.

In 1937 Kaoyza found that rotary and thermic stimulation increases the "tone" of the vegetative nervous system in man. This change is more pronounced on section of the parasympathetic.

In 1938 Hasama, working with pigeons, used the variation in potential of the adrenals, which he stated was equivalent to the electrical variation of adrenal secretion. He measured the variation with a galvanometer and found that thermic stimulation increases the secretion of epinephrine.

EFFECTS OF LABYRINTHINE SECTION

Regulation of Vasomotor Function.—In 1938 Mies noted variations in hypertension in rabbits shortly after labyrinthine suppression, whereas rabbits which had been subjected to unilateral section done by the Winkler-De Kleyn method showed no change in pressure when enough time had elapsed for the result of section to wear off completely.

In 1931 Le Heux and De Kleyn disclosed that a distinct diminution of motility of the gastrointestinal tract resulted from labyrinthine section in cats.

In 1931 K. Arslan disclosed that an inconstant miosis is noted in eyes.

Masini and Polimanti noted a variation in the amount of urine and of the phosphate and nitrate content.

In 1931 Nishihata, Harada, Tesina and Murakami observed that in pigeons unilateral labyrinthectomy caused adrenal hypertrophy, which reached its maximum in from six to nine days.

AUTHOR'S EXPERIMENTS

After careful elimination of extravestibular stimuli, Arslan found that there was not sufficient connection between vestibular stimuli and blood pressure to demonstrate an effect on hypertension and hypotension.

From his experiments he concluded further that the vegetative nervous system is not affected by vestibular stimulation. A. A. S. GIORDANO, Philadelphia.

COCHLEOVESTIBULAR DISTURBANCES OF MENIÉRÈ'S TYPE IN INTERNAL FRONTAL HYPEROSTOSIS (ENDOCRANIOSIS OF MORGAGNI). G. B. BELLONI, Riv. di clin. med. (supp. Margin. otolaryng.) **1**:68, 1940.

In this article Belloni states the belief that in women past the climacteric, i. e., past 50, symptoms referable to Menière's syndrome may develop, which may be due to hyperostosis and dysfunction of the hypophysis. He expresses the belief that this hyperostosis and vertigo have a connection with the climacteric and advises careful study of such cases. A. A. S. GIORDANO, Philadelphia.

CONNECTION BETWEEN THE ARTERIAL VESSELS AND THE EIGHTH CRANIAL NERVE. GUIDO FERRARI LELLI, Riv. di clin. med. (supp. Margin. otolaryng.) **1**:97, 1940.

Dandy reported that the variations of blood supply about the eighth intracranial nerve are such as to make it difficult to consider any one type as normal. Since in recent years the cerebellopontile angle has assumed increased importance because

of surgical procedures which are being done in this region, it became evident to Ferrari Lelli and his associates that a study of the vascularization of the region would be of particular interest to surgeons. Dandy, for example, who demonstrated the advantage of section of the eighth nerve in Menière's disease, had shown the possibilities for further investigation in this region.

Ferrari Lelli and his associates accordingly made an anatomic study of the region in persons from 35 to 80 years of age and tabulated their results.

According to the most recent classification of the cerebellar arteries by Luna and Fazzari, there is an arterial branch associated with the acoustic-facial nerve trunk, which from the surgical point of view is extremely important and which is usually termed the cerebellar anterior-inferior branch. Ferrari Lelli and his associates call this the posterior cerebellar artery. This vessel is a branch of the basilar artery. It usually runs along the bulbopontile sulcus, emerges with the acoustic-facial nerve at this point and runs along with the nerve toward the internal auditory meatus. It often forms an ansa in the horizontal plane, which lies hidden beneath the seventh nerve and the superior surface of the eighth nerve, thus making it necessary to consider an afferent and an efferent branch.

The disposition and behavior of the afferent and efferent branches of the cerebellar anterior-inferior artery are:

1. A long and narrow branch in the horizontal plane, placed on the eighth nerve, with afferent and efferent branches entwined, in connection with the cochlear nerve.

2. A short and thick branch in the horizontal plane, placed on the eighth nerve, with the afferent branch in front and away from the cochlear nerve and with an efferent branch which follows the anterior margin of this nerve.

3. A long branch in the horizontal plane, placed on the eighth nerve, with its branches near the internal auditory canal and separated from the eighth nerve during its retropetrosal course in such a manner that the afferent branch follows the anterior margin and the efferent branch follows the posterior margin of the nerve.

4. A short and a long branch in the horizontal plane, placed on the eighth nerve, the anteroposterior margins of which are limited respectively by the afferent branch and the efferent branch to the retropetrosal part of the nerve.

5. A short and thick branch in the horizontal plane, placed beneath the eighth nerve. The branches follow the anterior and posterior margins of the nerve, limited to its retropetrosal part.

6. A long and a short branch in the horizontal plane, placed on the eighth nerve. The afferent branch follows the anterior margin of the seventh or eighth nerve or runs between these two nerves, the efferent being situated between the two divisions of the eighth.

7. For the shortest, in the horizontal plane, placed in front of the acoustic-facial nerve, with the afferent branch following the cochlear nerve and the efferent, the seventh nerve.

A. A. S. GIORDANO, Philadelphia.

Nose

SURGICAL ESTABLISHMENT OF NASAL VENTILATION. SIDNEY N. PARKINSON, Ann. Otol., Rhin. & Laryng. **49**:1023 (Dec.) 1940.

The physiologic functions of the nose are: respiration, with warming and humidifying of the air; olfaction; controlling infection and modifying the voice. All of these functions depend on proper ventilation of the nose. The main causes of nasal obstruction which come within the scope of this paper are: (1) deviation

of the septum; (2) persistent congestion of the mucosa; (3) persistent edema of the mucosa and (4) mucosal hyperplasia. To correct the conditions the author considers five surgical procedures: (1) submucous resection; (2) resetting of the inferior turbinate; (3) reduction of the inferior turbinal bulk; (4) antrostomy, and (5) reduction of the middle turbinal bulk. Obstruction from mucosal changes may be taken care of in many cases by control of allergic or endocrine disorders and by treatment of nasal and sinal conditions. If these do not clear up, a resort to surgery is indicated.

M. V. MILLER, Philadelphia.

THE RELATION OF SINUSITIS TO CHRONIC NONTUBERCULOUS CHEST INFECTION. ROBERT L. GOODALE, New England J. Med. **223**:654 (Oct. 24) 1940.

The results of a study of the relation of sinusitis to bronchiectasis are presented. At the pulmonary clinic of the Massachusetts General Hospital, 150 patients were examined. Chronic sinusitis was present in 55 per cent, demonstrated by roentgenograms. Clinical evidence of recurrent sinusitis brought the incidence of sinusitis to 86 per cent. However, several different diseases occur at the onset of bronchiectasis. At onset there may be sinusitis as well as pulmonary infection. In addition to cough as the cause of the bronchial dilatation, there may be the foreign body effect of infected secretion. The most important problem is whether the sinusitis is a major or a minor factor. This governs the treatment, and only in severe chronic sinal infection is operation considered.

Of the 150 cases 76 per cent were analyzed in detail and separated into four groups. The first group comprised 21 cases in which lobectomy was done in the absence of sinusitis. Eight of the patients in this group were symptomless at the time of writing and 8 raised a slight amount of sputum, while 5 raised a moderate amount but showed definite improvement. The second group comprised 14 cases in which lobectomy was done and sinusitis was not treated surgically. Ten of the 14 patients showed marked improvement, while the condition of 4 was unchanged and they seemed to be candidates for sinal operations. In the third group, in which both lobectomy and a sinal operation were performed, none of the 11 patients became symptom-free so far as the chest is concerned. At the time of writing, 7 had very little sputum. The condition of 2 was considerably improved, while that of 2 was unchanged. Of 30 patients in the fourth group, who were treated by sinal operation alone, 3 became symptom-free, but they had a minimal number of symptoms at operation. The condition of 13 was considerably improved, while that of the remaining 14 was unchanged. It is not suggested that surgical treatment of the sinuses will be followed by eradication of the bronchiectatic cavity. Such treatment is not an alternative to lobectomy when the latter is advisable.

SCHALL, Boston.

CHARLIN'S SYNDROME. G. LUGLI, Riv. di clin. med. (supp. Margin. otolaryng.) **1**:89, 1940.

Charlin's syndrome is a group of symptoms of a neuralgic nature, referable to the distribution of the nasal nerve. It was first described by Badal, in 1884, and more fully by Charlin, in 1931. The pain is sharp, lancinating and of a neuralgic nature, often asserting itself as a burning. Active pain manifests itself generally with pressure over the external exit or at the superinternal angle of the orbit or at the alae of the nose. There is vasodilatation, with occlusion of the nasal chambers and profuse aqueous discharge and sneezing, as well as ocular disturbance of a vasomotor type, with secretion, hyperemia of the conjunctiva, lacrimation, corneal irritation and exfoliation, superficial erosion of the cornea and often iritis.

Charlin divided the symptoms into the nasal, the ocular and the neuralgic. The condition, except for its distribution, is similar to the syndrome of the sphenopalatine ganglion neurosis.

Lugli supplies the following differentiation:

Nasal Nerve Neurosis	Sphenopalatine Ganglion Neurosis
Ocular lesions present.	No ocular lesions present.
Congestion of the nasal fossae (antero-superior) always present.	Congestion of the posterior region of the nose.
Marked congestion of the anterior part of the inferior turbinate.	Congestion of the posterior end of the middle turbinate.
Superficial pain in the alae and the external part of the nose.	No superficial painful areas.
Cutaneous eruption of the nasal fossa and the orbit.	No cutaneous eruption.
Cessation of symptoms with the application of cocaine and epinephrine to the anterior nasal mucous membrane.	Cessation of symptoms obtained by the application of cocaine and epinephrine to the area of the sphenopalatine ganglion.

A. A. S. GIORDANO, Philadelphia.

Miscellaneous

NASAL FLORA OF THE CHILDREN IN A DAY NURSERY. H. S. YANG, Am. J. Dis. Child. **61**:262 (Feb.) 1941.

The ebb and flow of the common bacterial pathogens of the respiratory tract were observed in a study of 50 children in a nursery. Potential pathogenic material appeared in great profusion and on occasion even in almost pure culture. Common types of Pneumococcus were found (VI, XIX, XXII and XXIII). Type III was rare, and type II was not found. Haemophilus influenzae was the next most common pathogen found. Streptococcus haemolyticus rarely appeared in the culture, and when it did, was usually associated with illness of the subject.

ROBERT B. LEWY, Chicago.

ROLE OF OXALIC ACID AND CERTAIN RELATED DICARBOXYL ACIDS IN TREATMENT AND CONTROL OF HEMORRHAGE. H. I. SEGAL and H. M. PARRIS, Ann. Otol., Rhin. & Laryng. **49**:1008 (Dec.) 1940.

Experiments were made with various extracts from plants to determine their effect on the clotting time of blood when administered directly into the blood stream or intramuscularly. The active principles of these extracts were oxalic acid and certain related dicarboxylic acids. One of the best preparations was that from shepherd's purse. The extracts were found free of protein and alkaloids; therefore there was no danger of anaphylaxis or habit formation. No thrombosis was seen in any of several thousand patients treated, and no untoward general or local reactions were observed, even though the patient was treated over a long period. Investigation showed the normal values for oxalic acid in the human blood to be 5 to 7.5 mg. per hundred cubic centimeters, and there was a definite correlation between the oxalic acid content and the clotting time. A method for determining the oxalic acid content of the blood is described. The authors report successful use of the preparation in the prophylaxis of bleeding and in the control of hemorrhages.

M. V. MILLER, Philadelphia.

INSTANTANEOUS PHYSIOLOGIC DEATH. SOMA WEISS, New England J. Med. **223**:793 (Nov. 14) 1940.

Weiss states that postmortem examination of the body has been and still is the most valuable method for determining the cause of death. Today the use of physical and chemical methods often yields additional information which can be obtained in no other way. However, even by these methods postmortem study alone does not always give a precise explanation of the exact mechanism of death.

One of the most perplexing problems is the explanation of instantaneous death. The term "sudden death" is frequently used to describe the occurrence of unexpected death within several minutes after the onset of symptoms. Often death is called sudden if a person is found unexpectedly dead as the result of natural causes. The underlying diseases and mechanisms of sudden death are multiple; coronary disease in particular, other types of heart disease, cerebrovascular accidents, pulmonary embolism, dissecting aneurysm of the aorta, internal hemorrhage, obstruction of the trachea and various types of poisoning are mainly responsible. However, in many cases when an underlying organic disease of vital organs is found, it must be remembered that there are persons in whom there may be structural damage of equal or greater severity who have good functional capacity. The question therefore arises: Why with the same degree of structural damage present should death occur in one person and not in another?

Observations by Weiss indicate that instantaneous death is usually cardiac in origin and that its occurrence depends on an underlying physiologic mechanism. He believes that there is a close interrelation between the mechanism of instantaneous death and syncope and that instantaneous death is nothing else than fatal syncope.

The essential difference between syncope in health and in certain diseased states lies in the ability of the subject to reestablish normal bodily equilibrium. In normal persons a return to normal cardiovascular equilibrium is accomplished with relative ease and promptness, and in diseased persons, because of damage to systems or impairment of the reserve capacity of organs, a return to the normal is slower and more difficult and in fact may never occur.

In syncope the circulation is markedly influenced by gravity, and so the disturbance may be particularly severe when a patient is in the orthostatic position. Thus, in patients with myocardial disease, pleural, pericardial or abdominal tap is more apt to lead to instantaneous death if the patient is sitting than if he is recumbent.

Weiss believes that it is more than a coincidence that cerebral ischemia is one of the stimuli effective in bringing on unconsciousness, abolishing muscular activity and causing convulsive movements. The combined effect of these changes is an improved return of blood to the heart and brain.

In the presence of an ischemic myocardium and hyperactive reflexes, fright or other emotional stress may induce cardiac arrhythmia, syncope and even death.

Summary.—Postmortem examination fails to explain the mechanism of sudden death. In the majority of cases the underlying structural lesions are chronic, and lesions of the same type may be found in cases in which they do not contribute to the cause of death. In the causation of instantaneous death a myocardiac hyperirritability of anorexic or infectious origin and hyperactive reflexes, singly or in combination, play the most important roles. The determining factor in instantaneous death is often physiologic. Instantaneous death is often fatal syncope.

SCHALL, Boston.

INDICATIONS FOR GASTROSCOPY. E. B. BENEDICT, New England J. Med. **223**:925 (Dec. 5) 1940.

Gastroscopy has become a generally accepted method of examining the stomach. Particularly is it important in studying color and detail, and since no other procedure furnishes such information, it is obvious that gastroscopy supplements but does not supplant other methods of examination.

Roentgen examination of the esophagus and stomach is always carried out before gastroscopy, to exclude any esophageal lesion which might contraindicate the passage of the gastroscope. The stomach should be emptied of secretions, the patient should be given ½ grain (0.03 Gm.) of codeine and 1/150 grain (0.0004 Gm.) of atropine and the throat should be anesthetized with a 2 per cent solution of pontocaine hydrochloride used as a gargle.

The first indication for gastroscopy is gastritis. It is in the observation of the finer changes in the gastric mucosa that the procedure has its greatest field of

usefulness, and since gastritis is the commonest disease of the stomach, the value of gastroscopy is self evident.

A second important indication for gastroscopy is unexplained gastrointestinal hemorrhage. It is emphasized that gastroscopy should be performed within a few days after the hemorrhage, for a delay of even a week will not infrequently mean healing of the mucosa and a false negative result of examination. Since erosions and ulcerations often heal with amazing rapidity, the dictum is "Perform gastroscopy early."

A third important indication for gastroscopy is so-called "gastric neurosis." That a patient appears neurotic and roentgen examination fails to reveal any basis for symptoms does not necessarily mean that there is no basis. Chronic gastritis may be the cause of the symptoms and a contributing factor in the nervous condition of the patient.

A fourth indication for gastroscopy occurs in cases in which roentgen examination gives negative results but gastrointestinal symptoms persist. In such cases the history, laboratory work and clinical findings definitely point to the stomach as the seat of the patient's distress, but the lesion may well be of such proportions that roentgenograms are either negative or inconclusive. The lesion may be erosive, malignant or hypertrophic.

Gastroscopy is of value in many cases of gastric ulcer, in determining the appearance of the lesion as an aid to future treatment, operation and prognosis. In a like manner, the healing process can be followed in many cases.

In polyposis of the stomach, gastroscopy frequently gives essential information regarding the size of the polyps, their basal attachment and their general appearance. It also gives clues as to operability and is of great importance in determining the operative procedure.

Postoperatively, gastroscopic examination of the stomach is of great value. Many patients after gastroenterostomy or gastric resection continue to have symptoms, some mild and some severe. Some complain of the same symptoms that were present before operation, but many present vague symptoms that are often unexplained by the usual studies. Gastroscopy frequently demonstrates severe postoperative gastritis.

Another indication for gastroscopy is the presence of a foreign body in the stomach. For many years, when such a body was known to be present the open tube gastroscope has been used in removing it. The new flexible gastroscope, however, may be useful in differentiating between a foreign body and a polyp in the stomach.

Benedict summarizes his article substantially as follows:

Gastroscopy is now a generally accepted method of examining the stomach. Gastroscopic examination can be carried out easily in the outpatient department with the aid of one assistant. Various indications for gastroscopy are given, namely, gastritis, unexplained gastric hemorrhage, "gastric neurosis" and negative or inconclusive results from roentgen examination. The gastroscope is used in determining the appearance and location of a gastric lesion, in following the healing process and in examining the stomach after operation. It may also be used in determining whether an abnormal appearance represents a polyp of the stomach or a foreign body.

SCHALL, Boston.

RESPIRATORY DEPRESSION DURING ANESTHESIA ATTRIBUTABLE TO CAROTID SINUS DISTURBANCES. CHARLES L. BURSTEIN, New York State J. Med. **40**:1767 (Dec. 15) 1940.

Working in the New York University Department of Anesthesia, Burstein has made certain observations and reviewed experimental data which reveal that when the respiratory center is depressed by a sedative, with resulting anoxia, the inhalation of oxygen (contrary to popular belief) may be followed by respiratory depression. One must remember that a depression of the respiratory center due to sedation (morphine) plus a lack of oxygen calls forth respiratory movements from anoxemic stimulations of the carotid body. Removal of this stimu-

lation by the application of oxygen inactivates the carotid body and produces an uncompensated depression of the respiratory center. Damage to the respiratory nuclei through damage to the central nervous system by excessive sedation calls for no asphyxial stimulation of respiration. On the contrary, artificial or "controlled" respiration with adequate oxygenation should be maintained until the respiratory center regains the power to function properly, unaided. In general, the potency of any preanesthetic sedative should be reduced pari passu with the potency of the general anesthetic to be used. Synergy of drugs in this instance may be a great danger to the life of the patient. If this is borne in mind, "deaths on the table" may well be substantially reduced in number. A perusal of this article is recommended to every surgeon, whatever his specialty.

VOORHEES, New York.

PRIMARY CARE OF INJURIES OF THE FACE AND JAWS. V. H. KAZANJIAN, Surg., Gynec. & Obst. **72**:432 (Feb.) 1941.

One cannot overemphasize the importance of early adequate treatment of injuries to the face and jaws as the greatest safeguard against serious complications and subsequent deformities. In dealing with injuries of the soft tissues of the face, if the general condition of the patient permits, the ideal time for suturing is immediately after the accident, i. e., within five to six hours, before bacterial multiplication has occurred. Not all facial wounds are ready for suturing. They can be made so within two to ten days by (1) thorough mechanical cleansing, (2) application of frequent hot boric acid fomentations and (3) maintenance of free drainage of the wound.

The injuries may be complicated by underlying bone fractures, which should be reduced and immobilized as soon as possible. Simple malar fractures can easily be reduced during the first week, but when they are complicated by a fracture of the maxilla involving the maxillary sinus, drainage of the sinus must be provided as well as immobilization of the reduced fractures. Fractures of nasal bones should be treated early, especially in children. Treatment of fractures involving the jaws consists in closing all lacerations in the mucous membranes, removing broken teeth and teeth in the line of fracture and immobilization so that the teeth are in normal alinement. The last measure insures that good function will result when healing has taken place.

H. A. MILLER, Philadelphia.

TREATMENT OF TUMORS OF THE PAROTID GLAND, WITH SPECIAL REFERENCE TO TOTAL PAROTIDECTOMY. HAMILTON BAILEY, Brit. J. Surg. **28**:337 (Jan.) 1941.

A new concept of the relations of the facial nerve and the parotid gland is presented. According to Bailey, the parotid gland consists essentially of a large superficial lobe and a small deep lobe. These are connected by a comparatively small isthmus, which is variable in size but rarely absent. The main trunks of the facial nerve, the temporofacial and the cervicofacial divisions, embrace the isthmus, but no part of the facial nerve runs actually within the gland substance. In order to improve the results obtained in the management of mixed tumors, Bailey describes an operation to extirpate the gland completely with preservation of the facial nerve. Five cases are reported with only 1 case of temporofacial paralysis. This condition improved with time; in all cases the operation was successful as to complete cure of the tumor.

H. A. MILLER, Philadelphia.

Society Transactions

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April 16, 1941

Neurofibroma of the Larynx: Report of a Case. DR. EMILY LOIS VAN LOON.

The patient, a 17 year old girl, first came to my attention in July 1940, when she was sent to the Woman's Hospital for tonsillectomy. Operation was postponed because of her marked hoarseness, which had been developing over a period of two years. Inspection of the larynx with the mirror and then with the direct laryngoscope showed the left ventricular band to be full and bulging, overhanging the left vocal cord. The band felt soft and cystic, and the cord was thickened. Tissue superficially removed from the anterior end of the cord was reported to be striated muscle fibers. At this time the Wassermann test was negative and roentgenograms of the chest revealed no changes.

The patient was discharged; three months later she was readmitted for another laryngoscopic examination. The swelling in the ventricular band was slightly larger, but the band was still perfectly smooth and rather soft. Biopsy of the band was attempted, but taking a specimen was somewhat like taking a specimen from an inflated balloon. The scrap of tissue obtained was reported to be "dense fibrous tissue covered with stratified squamous epithelium." Meanwhile the patient was becoming increasingly hoarse and had some local discomfort, although there was no marked dyspnea or dysphagia. As the Woman's Hospital was not equipped for making planographic roentgenograms which were desired, the patient was referred, Jan. 20, 1941, to Temple University Hospital for these studies. The first slide shows well the extent of the tumor. The radiologist's report was as follows: "There is a rounded smooth mass on the left side of the patient's larynx, which measures 3 cm. in diameter. The smoothness of the mass suggests that it represents a benign cyst of the larynx. The retropharyngeal and retrotracheal soft tissue appear quite normal."

Direct laryngoscopic examination showed that the tumor now was much larger than at the first examination, obliterating the ventricle and the vocal cord, so that the left side of the larynx was a smooth rounded line from the aryepiglottic fold to the subglottic region. The second slide shows the mirror image of the larynx at this time.

On January 24, with the region under local anesthesia, a laryngofissure for excision of the growth was done. The thyroid cartilage was split at its angle, and the interior of the larynx was inspected. Incision through the mucous membrane at the anterior commissure revealed a white glistening capsule. In the attempt to remove the tumor by blunt dissection the capsule broke, and very soft, almost gelatinous-looking tissue was extruded. The tumor with its capsule apparently was removed completely, leaving a large pocket between the mucous membrane and the thyroid cartilage. The mucous membrane was then anchored anteriorly to the cartilage with a catgut suture, and the incision was closed. A low tracheotomy was done, to insure against postoperative dyspnea. This proved to be wise, for the airway was markedly narrowed by postoperative swelling and the tube could not be removed until the eighteenth postoperative day.

The pathologist's report on the tumor was as follows: "The tumor cells are fusiform and have a rather monotonous appearance. The nuclei are rather finely granular, though the chromatin stains deeply. The cytoplasm is somewhat vacuolated and stains pale pink, and the cell membrane is poorly defined. The tumor is extremely cellular. The cells show little variation in size, and there is little stroma in between. There are several areas of hemorrhage."

The diagnosis was neurofibroma.

Yesterday, a little less than three months after operation, the right side of the larynx was normal; the left side showed impairment of motility. There was a sharp margin of vocal cord from the anterior to the posterior commissure. The membrane sloped up to the aryepiglottic fold without any sign of bulging. The ventricle could not be outlined. After the operation the patient was aphonic, but the voice is now considerably improved.

Cerebellar Abscess. DR. BENJAMIN H. SHUSTER.

This article appears in full in this issue of the ARCHIVES, page 952.

DISCUSSION

DR. ROBERT J. HUNTER: The interesting thing to me in Dr. Shuster's paper is his statement that one must follow one's own judgment and not become too much involved with complicating opinions compiled from the literature. His paper calls to mind especially a case of mine in which events proved that it is better to use one's own judgment than to follow the regular rules of procedure. Fifteen and a half years ago I was called into consultation by a general surgeon, Dr. G. Mason Astley, on bilateral mastoiditis in a child 5½ years old, who had a temporosphenoidal abscess. Two months after a mastoid operation was performed, an abscess was evacuated from the left temporosphenoid region. It was well encapsulated and contained 25 cc. of pus. A rubber tube was inserted into the cavity. Whenever the tube became obstructed, the dressing was changed. Each time this occurred, the patient experienced a sharp rise of temperature. I suggested that the drain be left in place. The surgeon said that the pus in the abscess cavity should be evacuated. With this divergence of opinion, we called Dr. Charles Frazier into consultation. He agreed with the surgeon, saying that it was a surgical principle to give free drainage to pus and that this should be observed. In accordance with his advice the rubber tube was changed again. This was followed by cerebritis and high fever similar to that which had occurred on previous occasions. After the tube was changed, the condition of the patient was so alarming that we decided to leave the tube in place thereafter. The patient recovered. This was the first case, evidently, in the experience of the three consultants in which they had observed that it is better to leave the packing of an abscess of the brain undisturbed. Since that time this has become a well established principle.

I also had a patient with cerebellar abscess accompanying mastoiditis who presented a complication that demanded immediate action without much choice of procedure. In the course of the acute mastoiditis intracranial symptoms appeared, with an increase in the spinal fluid cell count and nuchal rigidity. At operation the posterior fossa was exposed. Attention was drawn to the lateral sinus, which appeared to be involved. When this was opened, there was free bleeding, which necessitated the use of packing. The increased pressure produced by the packing was too much for the respiratory center, and the patient immediately stopped breathing. When the packing was withdrawn, the patient breathed, but bled furiously. There seemed to be no alternative but to stop the hemorrhage by packing and to support the patient with artificial respiration, which was skilfully carried out by the anesthetist, who had been used to the intratracheal method of inducing anesthesia. This is ideal for the application of artificial respiration. Search for a cerebellar abscess was unsuccessful. After prolonged operation the patient was placed in

a Drinker respirator. Eight hours later another operation was performed and a search for an abscess was made supratentorially, without success. Then the cerebellum was explored again, and an abscess was evacuated. The patient, however, never resumed natural respirations and died after about seventy-two hours in the respirator. In each of these cases a complication arose which had to be met on the basis of the emergency existing at the time rather than on that of the operator's knowledge of literature or precedent.

I want to emphasize that I agree with Dr. Shuster that one must meet the complications of a case as they arise with some degree of independence, which is, after all, the basis of good surgical judgment.

Unusual Mobility of the Tongue: Report of a Case. DR. LOUIS E. SILCOX.

The author presented a study of the sore throat which was frequently associated with infection of the upper respiratory tract in a man with a congenital anomaly which enabled him to make direct observations of the nasopharynx with the tip of his tongue. Such hypermobility of the tongue may be congenital, or it may be acquired by a person suffering from chronic rhinitis, in an effort to moisten the dry mucous membranes and to remove the crusts which form in the nasopharynx. Removal of the crusts from the nasopharyngeal side of the soft palate relieves angina and painful deglutition. The removal of crusts from the posterior surface of the nasopharynx does not affect the angina. The crusts are at first bloody but later mucopurulent. This patient never had typical tonsillitis or sore throat in the absence of infection of the upper respiratory tract. Evidently the sore throat is due to acute superficial ulceration of the nasopharyngeal surface and of the soft palate, the pain arising from the denuded areas on movement of the soft palate being referred to the throat in general. The relief obtained by means of an abnormally mobile tongue can be reproduced in patients with normal lingual mobility by the use of warm gargles or the application of medicaments on a curved wire applicator. With the latter instrument the crusts can be swept off and a healing preparation applied to the surface at the same time.

DISCUSSION

DR. ORAM R. KLINE: When Dr. Silcox told me that he was planning to report this unusual case, I offered to bring along 1 of my patients, who is able to demonstrate similar coordinated mobility of his tongue. He flexes the dorsum of his tongue and passes the tip behind the soft palate into the nasopharynx, causing the tip to be present at either the right or the left posterior naris, as requested. The tip of the tongue can then be seen readily by anterior rhinoscopy. He can also pass the tip of the tongue downward into the laryngopharynx, touching the epiglottis.

This unusual accomplishment has enabled him to treat his own nasopharynx when it has been inconvenient for him to go to a doctor. When he was a traveling salesman, he always carried a medicated ointment, which he applied to his nasopharynx with the tip of his tongue when he thought treatment was indicated.

Percussion Note Over the Maxilla as a Differential Diagnostic Sign. DR. WILLIAM HEWSON.

I wish to direct attention to percussion as a means of eliciting valuable signs in disease of the maxillary sinus. Percussion of a normal maxillary sinus of a young adult gives a modified tympanitic note. This varies to "impaired resonance," depending on the size and development of the sinus, the thickness of the bony walls and the character of the partitions. In subjects with unerupted teeth and thick skull bones there is greater impairment of resonance, for the pitch is raised and the duration of the sound is shortened.

Acute congestion or inflammation of the maxillary sinus increases impairment, depending on the amount of swelling in the sinal mucous membrane and the

increase of blood or fluids in the surrounding tissues. Resonance is defined as a long clear low-pitched sound which implies amplification of a fundamental note by synchronous vibrations from the surrounding tissues. As the tissues become thicker and therefore less air bearing, the pitch is raised, the sound is shortened, and there is loss of amplification.

Chronic inflammation, with thickening of the sinal mucous membrane, the presence of polyps or the accumulation of liquid will raise the pitch still higher, until "dulness" results. Percussion of a sinus filled with such tissue or fluid will elicit "absolute dulness" or "flatness."

Percussion of an atrophic sinus without an accumulation of liquid but with a large thin-walled dry cavity, will elicit a typical tympanitic note. Tympany contrasted with resonance is a musical note, rich in overtones but maintaining a clear fundamental quality due to rhythmic vibrations.

Succussion splash, though not truly a percussion sign, is not infrequently heard in atrophic maxillary sinuses containing fluid and air. It is sometimes heard by the examiner but more often by the patient.

The method of eliciting the percussion note of the maxillary sinus may be:

1. By direct percussion—striking with the plexor finger directly on the superficial malar prominence. This is immediate percussion, which is not so reliable, because of diffusion in the bone.

2. By indirect percussion, or mediate percussion, in which another finger is interposed as a pleximeter. By this method the terminal phalangeal joint is firmly pressed against the thinnest part of the malar bone in the canine fossa. The examiner strikes the joint a short sharp blow with the plexor finger, being careful to use only enough force to activate the air in the maxillary sinus.

If the alveolus is struck, a tympanitic note will be obtained from the oral cavity. Usually it is best to have the patient's mouth flaccidly open. This helps to eliminate the oral tympany. An upper plate or removable false teeth should be taken out before one tries to percuss the sinus. It is of course necessary to have quiet in the room, for the sound will not be loud. In fact, it will be less loud than that produced by percussion of the chest, which gives amplification from its bony wall. In comparing the notes over the two maxillas, care should be taken to have the pleximeter finger in comparable positions.

An important adjunct to percussion is the recognition of resistance. This is felt by the plexor as well as the pleximeter finger. One takes note of it while percussing, as a deafened person reads lips. Resistance over the maxillary sinus obtained in this way may vary considerably.

The object of this presentation is to stress the use in otolaryngologic practice of all the special senses and to urge the checking of one against another and the acquiring from each of its own peculiar contribution toward a balanced diagnosis. In relating abnormal percussion findings to diseases of the maxillary sinus it is evident, as Flint pointed out, that "the significance of morbid signs relates immediately not to diseases, but to the physical conditions incident thereto. Signs are not directly diagnostic of particular diseases."

Book Reviews

Infantile Paralysis: 1941. Price, $1.25, cloth. Pp. 228. New York: The National Foundation for Infantile Paralysis, Inc., 1941.

This book represents a series of six lectures delivered at Vanderbilt University, Nashville, Tenn., on April 7, 8, 9, 14, 15 and 16, 1941, under the auspices of the National Foundation for Infantile Paralysis, Inc.

Each lecture, given by a man distinguished in his particular field, deals with a different phase of the disease. Thus, the history, etiology, immunologic and serologic phenomena, pathology and pathogenesis and epidemiology and treatment of poliomyelitis and the rehabilitation of patients are adequately discussed.

The extensive bibliography includes 575 references, and the index is informative.

This volume should be of particular interest to the otolaryngologist because of the detailed discussion of the virus with reference both to the known portals of entry and exit (the nasal mucosa and the nasopharynx) and to other likely routes.

No claim is made for a final solution of the intricate problem of combating poliomyelitis, as stated in the preface, but it is hoped that the lectures in this book will show the amount of work that has been done and stimulate further effort.

Though this disease is far afield from otolaryngology, the bacteriologic factors in the nose and nasopharynx will interest most otolaryngologists, and for this reason the volume should be in the library of every one.

Directory of Otolaryngologic Societies *

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Gordon F. Harkness, 215 Main St., Davenport, Iowa.
Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia.
Place: Atlantic City. Time: June 8-12, 1942.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Frank R. Spencer, Physicians' Bldg., Boulder, Colo.
President-Elect: Dr. Ralph I. Lloyd, 14-8th Ave., Brooklyn.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: San Francisco. Time: Oct. 11-15, 1942.

American Broncho-Esophagological Association

President: Dr. W. Likely Simpson, 899 Madison Ave., Memphis, Tenn.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago.
Place: Atlantic City, N. J. Time: June 8-9, 1942.

American Laryngological Association

President: Dr. T. E. Carmody, 227-16th St., Denver, Colo.
Secretary: Dr. Charles J. Imperatori, 108 E. 38th St., New York.
Place: Atlantic City, N. J. Time: May 25-27, 1942.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
President-Elect: Dr. James G. Dwyer, 375 Park Ave., New York.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Place: Atlantic City, N. J. Time: June 1-3, 1942.

SECTIONS:

Eastern.—Chairman: Dr. Henry P. Johnson, 32 Deering St., Portland, Maine.
Place: Portland, Maine. Time: Jan. 15, 1942.

Southern.—Chairman: Dr. William L. McDougall, 915 Doctors' Bldg., Atlanta, Ga.
Place: Atlanta, Ga. Time: Jan. 23, 1942.

Middle.—Chairman: Dr. William E. Sauer, 3720 Washington Blvd., St. Louis, Mo.
Place: St. Louis. Time: Jan. 21, 1942.

Western.—Chairman: Dr. Emil F. Tholen, 1136 W. 6th St., Los Angeles.
Place: Los Angeles, Calif. Time: Jan. 15, 1942.

American Otological Society

President: Dr E. M. Seydell, 107 W. Douglas Ave., Wichita, Kan.
Secretary: Dr. Isidore Friesner, 101 E. 73d St., New York.
Place: Atlantic City, N. J. Time: May 28-29, 1942.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.